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THESIS

WHAT DO CHIEF INFORMATION INTEGRATION OFFICERS (CI^2O) NEED TO KNOW AND WHAT IS THEIR ROLE?

by

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September 2000

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WHAT DO CHIEF INFORMATION INTEGRATION OFFICERS (CI^2O) NEED TO KNOW AND WHAT IS THEIR ROLE?

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN INFORMATION TECHNOLOGY MANAGEMENT

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ABSTRACT

As DoD and the Navy move into the 21st Century, information technologies are abounding not only in volume but also in complexity. In order to manage and leverage these technologies, there needs to be a clear vision and it must start at the very top of the DoD Enterprise. With this vision, it will then become the responsibility of the Chief Information Integration Officer (CI^2O), previously known as the Chief Information Officer (CIO), at each command to implement that vision. The real challenge is determining what exactly the CI^2O needs to know and the role the CI^2O should play in the command. Once the requirements are identified, how do we ensure the officer's success? This thesis examines these questions. The results of a meta-analysis from a variety of studies are portrayed in a matrix which identify the critical success factors, reporting levels, roles, core competencies, education and experience to in an effort to clearly define the requirements for an effective CI^2O to be implemented into Navy organizations.

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I. INTRODUCTION

> To reap the full benefits of new technologies, the Navy must have effective information management leaders who can transform IT dollars into prudent investments that achieve cost savings, increase productivity, and improve the timeliness and quality of service delivery. This was widely recognized by the Congress in the 1990s as it worked in conjunction with the administration to craft several key information management reform laws, notably the Federal Acquisition Streamlining Act of 1994, the revision of the Paperwork Reduction Act (PRA) in 1995, and the Clinger-Cohen Act of 1996. Other than the Computer Security Act of 1987, these were the first major information management reforms instituted in the federal government since 1980. The Clinger-Cohen Act, for example, required major departments and agencies to appoint CIOs and implement IT management reforms largely grounded in successful commercial IT management practices. In particular, the act established CIO positions that report directly to the agency heads and have IM as a primary function. CIOs are responsible for a wide range of strategic and tactical information management activities outlined in the Clinger-Cohen Act, such as developing architectures, managing and measuring the performance of IT investment portfolios, and assisting in work process improvements. This mirrors the evolution of the CIO position in industry where it has largely moved from solely a technical support focus to a much more executive and strategic level position. (GAO/T-AIMD-00-128)

The development of the Chief Information Integration Officer (CI^2O) is critical to any organization. The new title of (CI^2O) is suggested as a change in paradigms from the title of CIO that was not very well defined and had different meanings to each organization that used the title. This new title represents an individual fulfilling a role, which completely integrates the information management and technology requirements for an organization. The new title is a concise description of the role and the individual that can meet these needs for the Navy in its journey to excel in an environment of "information superiority" in

a mature learning organization. The position is needed to help organizations incorporate continuously evolving information technology (IT)[1]. As organizations evolve technologically eventually they mature into a "learning organization[2]." Figure 1.1 is a model of a vision of a mature information focused organization, a learning organization. The model is not all about technology, such as computers; it includes people and the information process flow of the organization. The centerpiece of the model pictures an interoperable triad: the organization, technology and people. The people in this model are interchangeable; that is not to say that they are like spare parts for a machine, but information technology is now a core competency of its people in the organization. People understand the importance of accurate information and how technology enables the flow of information. The mature information organization implements and maintains policies that address the knowledge worker's needs. In this new organization the (CI^2O) senses and responds to the needs of the organization and environment instead of reacting to innovative technologies.

---

[1] Information Technology: The term "information technology" includes computers, ancillary equipment, software, firmware and similar procedures, services (including support services), and related resources (TechWeb).

[2] Learning Organization: Organization that is continually expanding its capacity to create its future (Senge, 1990).

Enterprise architecture planning[3] is the norm for organizations of this type. The definition of the organizational boundaries and the environment is like an ameba, with a semi-permeable membrane that allows objects to pass in and out as needed, as depicted by the dashed lines. Likewise people, information and technology transition throughout the organization and environment to accomplish the mission. In a mature organization, the mission of the enterprise is clearly stated through the governance of information policies developed not by the CI^2O alone, but by the command executive committees. This governance

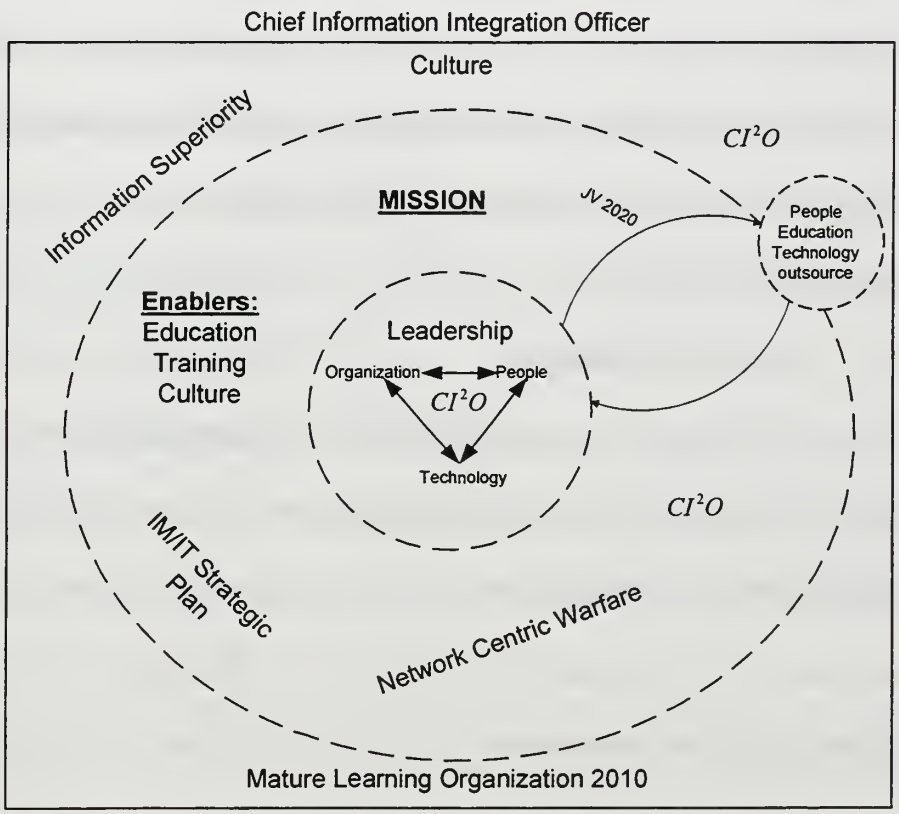

Figure 1.1 Mature Learning Organization Model

[3] Enterprise Architecture Planning: is a composition of (1) components (including humans) with their functionality defined (Technical), (2) requirements that have been configured to achieve a prescribed purpose or mission (Operational), and (3) their connectivity with the information flow defined. **OR**, 1) a stable business model (Independent of organizational

addresses issues concerning the alignment of information technology and management with the organization's business plan. There are no departmental boundaries; but rather only business boundaries, which are somewhat blurred by the advent of virtual organizations.

This thesis provides a framework for the Navy to transition towards the visionary mature organization. The drivers that have influenced the Navy to this new organization are Joint Vision 2010, Joint Vision 2020, and Network-Centric Warfare, all of which share the vision of information superiority. The enablers include the implementation of education and training programs, the capitalization of the knowledge management process, and the constant evolution of the Navy culture. The evolution of this mature information organization will place the Navy as a leader in the era of the learning organization.

A. OVERVIEW

1. Problem Statement

In an era of rapidly changing information technology the government and Department of Defense (DoD) have published enormous amounts of guidance in the area of Information Management and Technology. This guidance was developed in an effort to increase the efficiency and effectiveness of the information technology investment.

---

boundaries, systems, and procedures) is the foundation for architectures, 2) data is defined before applications, and 3) data dependency determines the sequence for implementing application systems (Spewak, S.H. & Hill, S.C.).

With the documents and visions of the leadership in place the real problem is not in the guidance. The problem is that an inadequate number of fully qualified information management[4] (IM) and technology personnel exist to fulfill the industries demand both in the civilian market place and government (Robinson, 2000)[5]. The lack of skilled people who can translate the guidance into plans of action leaves the command's leadership at an impasse in making informed IT business decisions (Negroponte p. 7). In addition to the shortage of skilled people there appears to be no roadmap in place or in the plans for how to acquire them.

2. Purpose

The purpose of this thesis is to provide compelling evidence that a Chief information integration Officer (CI^2O) is needed at every command level in the U.S. Navy. A second objective is to define the knowledge and skill requirements to perform in the role as the CI^2O.

3. Background to the Problem

The new vision and strategies put forth by two Admirals, Network Centric Warfare[6] and IT21[7] portends a dramatic shift from the current day Navy's view

---

[4] Information Management: The discipline that analyzes information as an organizational resource. It covers the definitions, uses, value and distribution of all data and information within an organization whether processed by computer or not. It evaluates the kinds of data/information an organization requires in order to function and progress effectively (TechWeb).

[5] Marvin Langston is an A player. The first-ever CIO of the Navy Department, he ended his government stint as the deputy CIO of the entire Department of Defense. Langston was courted by a number of big companies for traditional CIO spots, but he decided instead to go to Salus Media in Carpinteria, Calif.—a new Web-based health-care company that offered him the COO spot—mainly because he no longer wanted to battle the old corporate mind-set (Robinson, 2000).

[6] NWC Definition Network Centric Warfare (NCW) is based upon the experiences of organizations that have successfully adapted to the changing nature of their competitive spaces in the Information Age. One of the major lessons learned is

of IT. A group eighteen mid-grade officers at Naval Postgraduate School, Monterey, California, in the context of creating their vision for the Navy of the future (30-Something, 2000). Their view expounds on the world of Admirals Cebrowski and Clemens. These combined visions of the Admirals and the 30-Something class paint a picture of information systems (IS)[8] of the future. The ISs operate and communicate with each other and provide an environment of non-interrupted communications and real-time information flow (interoperable[9]) without human interaction (Negroponte, 1995). Negroponte's and the author's assumption is that the world will no longer be operated on paper; the world will ship bits[10] instead of atoms of information (Negroponte, 1995). The

---

that without changes in the way an organization does business, it is not possible to fully leverage the power of information and its potential as a source of power. This potential is realized as a direct result of the new relationships among individuals, organizations, and processes that are developed. These new relationships create new behaviors and modes of operation. It is the cumulative impact of new relationships among warfighting organizations that are the source of increased combat power. NCW supports speed of command...the conversion of superior information position to action. NCW is transparent to mission, force size and geography. Furthermore, NCW has the potential to contribute to the coalescence of the tactical, operational, and strategic levels of war. In brief, NCW is not narrowly about technology, but broadly about an emerging military response to the Information Age (Alberts, Garstka, & Stein, 1999).

[7] The Navy's networking initiative called "Information Technology for the 21st Century (IT21)." It is an acceleration of the Command, Control, Communications, and Computer (C4) programs, and is being implemented as a team effort with participants form the Fleet, Chief of Naval Operations (CNO), N6, the Space and Naval Warfare Systems Command (SPAWAR). It is stated as a process that significantly increases the warfighting capabilities of the fleet through the reduction of operating and support costs and enhances quality of life of the deployed Sailors and Marines. The added benefit of this initiative is that it provides an "information backplane" to enable the "Network Centric Warfare" concept and warfare support (IT21).

[8] Information Systems: A business application of the computer. It is made up of the database, application programs, manual and machine procedures and encompasses the computer systems that do the processing.
The database stores the subjects of the business (master files) and its activities (transaction files). The application programs provide the data entry, updating, query and report processing. The manual procedures document how data is obtained for input and how the system's output is distributed. Machine procedures instruct the computer how to perform the batch processing activities, in which the output of one program is automatically fed into another program (TechWeb, 2000).

[9] Interoperable: The ability of two or more systems or components to exchange data and use information. (IEEE STD 610.12). The ability of two or more systems to exchange information and to mutually use the information that has been exchanged. (TechWeb).

[10] Bit: no size, color, or weight it can travel at the speed of light. The smallest atomic element in the DNA of information. It is a state of being on or off, true or false, up of down, in or out, black or white (Negroponte, 1995).

information/data[11] required for knowledge workers[12] to do their job or the individual requesting information or making a transaction will be entered into the system only once. The entry will be accomplished through devices such as, sensors, keypad, voice, touch or some other entry devices. In fact the devices will be dual in their purposes and actions as input and output instruments. The dual purposes will increase the levels of complexity but enrich the information available to the intended users. When the data is requested for transactions, similar to filling out forms for a purchase, the information will be populated[13] through various networked[14] applications[15]. The applications processing a request will query the requisite database(s) and provide the data to complete the transaction. The only data that the requestor will need to enter is the information that has never been entered or needs to be updated. The digitalization[16] of all information across all components of the government and civilian agencies is needed to accomplish this vision of interoperability and information superiority.

---

[11] Information/data: The summarization of data. Technically, data are raw facts and figures that are processed into information, such as summaries and totals. But since information can also be raw data for the next job or person, the two terms cannot be precisely defined. Both terms are used synonymously and interchangeably (TechWeb, 2000).

[12] Knowledge worker: requires a good deal of formal education and the ability to acquire and to apply theoretical and analytical knowledge. Requires a different approach to work and a different mind-set. Above all, they require a habit of continuous learning (Drucker, 1994).

[13] Populated: the entire aggregation of items from which samples can be drawn; the items once requested fill a block or field in a form or database (WordNet ® 1.6).

[14] Network: Refers to connected computers or servers (TechWeb, 2000).

[15] Application: Is software, which performs a specific task or function. Examples are spreadsheets, word processing, graphics, and sound. Application programs differ from Operating Systems or Utility software programs, which tend to be broader in scope (TechWeb, 2000).

[16] Digitalization or "digital nervous system": Microsoft's term for a network and set of enterprise applications that support multimedia for every user. It implies complete integration between intranets and the Internet via landline and wireless communications. In other words, the fully-integrated, super-advanced, electronic office of the future (TechWeb, 2000).

This interoperable world is interactive[17] and ubiquitous[18] for all users just as the telephone is today in most of the United States and Europe. And just as personal computers have the ability to adapt to power sources, the machine does it so the human doesn't have to worry about it (Negroponte, 1995). Most people will not need to know how the interoperable world works just that it does. The information systems in the interoperable world will be built on common open systems architecture. The interoperable world will need new rules that regulate the bits vice the atoms (Negroponte 1995). To bring the vision stated in this thesis to reality will require a combined effort of all professions (e.g., comptrollers, engineers, human resource managers, civil engineers, and Lawyers). But it will take a special type of individual to lead the technological, organizational and cultural transformation. The Chief Information Integration Officer (CI^2O) whose skills reflect the conclusions of this thesis is the leader for the challenge.

There are several documents published that provided guidance for information management in the Navy's environment. These documents focus on the requirements and strategies for the Navy and DoD's conceptual

[17] Interactive: A term describing a program whose input and output are interleaved, like a conversation, allowing the user's input to depend on earlier output from the same run. Back-and-forth dialog between the user and a computer (TechWeb, 2000).

[18] Ubiquitous: Existing or being everywhere, or in all places, at the same time; omnipresent (Webster's Revised Unabridged Dictionary, 1913).

implementation of the vision, *"Information Superiority*[19]*"*, and succeeding in the mission of managing information. Although the scope of this thesis is limited the identification of the knowledge and skill requirements of the CI^2O, the following documents are listed as references to the challenge the Navy faces in the quest to manage its information and obtaining information superiority. The directive documents for the Department of Defense and specifically the United States Navy include:

Congress:	National Defense Authorization and Appropriations Acts Government Performance and Results Act (GPRA) Federal Acquisition Streamlining Act Paperwork Reduction Act Clinger-Cohen Act
Administration:	Presidential Decision Directive 63 National Security Policy Executive Order 13011 Office of Management and Budget (OMB) Circular A-130 OMB Circular A-11
DoD:	Joint Vision 2010/2020 Quadrennial Defense Review GPRA Performance Plan DoD IM Strategic Plan
DoN:	Forward...From the Sea Operational Maneuver From the Sea 1999/2000 Posture Statement Revolution in Business Affairs Business Vision and Goals GPRA Performance Plan Strategic IM/IT Plan

[19] Information Superiority: the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same. Information superiority is achieved in a non-combat situation or one in which there are no clearly defined adversaries when friendly forces have the information necessary to achieve operational objectives. (JP1-02)

The emerging concepts for warfighting depend upon information being managed as a Department-wide resource. Joint campaigns should fully exploit the "information differential," which is the superior access to and ability to employ information effectively on the strategic, operational, and tactical situation that advanced United States (U.S.) technologies can provide our forces. This information differential requires a seamless interface between the "foxhole" and the support base, between intelligence and operations, and between the DoD and its suppliers.

B. INFORMATION SUPERIORITY

Information, information processing, and communications networks are at the core of every military activity. Throughout history, military leaders have regarded information superiority as a key enabler of victory. For example, during World War II, the breaking Germany's Enigma Machine's cipher code, which enabled the allies to intercept messages and ultimately save lives and better prepare for attacks. However, the ongoing "information revolution" is creating not only a quantitative, but also a qualitative change in the information environment that by 2020 will result in profound changes in the conduct of military operations. In fact, advances in information capabilities are proceeding so rapidly that there is a risk of outstripping our ability to capture ideas, formulate operational concepts, and develop the capacity to assess results.

While the goal of achieving information superiority will not change, the nature, scope, and "rules" of the quest are changing radically (JP1-02).

C. JOINT TECHNICAL ARCHITECTURE

The Joint Technical Architecture (JTA) provides the minimum set of standards that, when implemented, facilitates this flow of information in support of the warfighter. This environment, as outlined in the JTA, will look like a distributed information processing[20] environment in which applications are integrated; applications and data are independent of hardware; information-transfer capabilities ensure seamless communications within and across diverse media; information retains a common format and a common meaning; its architecture provides a common human-computer interfaces for users; and establishes effective means to protect the information. The current JTA concept is focused on the interoperability and standardization of information technology (IT). However, the JTA concept lends itself to applications in other technology areas when required to support IT interoperability requirements (JTA).

D. SCOPE

This thesis seeks to answer the following questions: 1) in the Network Centric Era does each command need a Chief Information Integration Officer (CI^2O)? 2. What are the knowledge and/or skill requirements of that CI^2O? The answers to these questions were obtained by synthesizing:

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[20] The philosophy behind this is that all computers are not equal and some computers perform some tasks better than others. So, when a particular task needs to be performed, the client connects via the network to the best computer for the job at hand, passes the data to that computer via the network to that computer which then carries out the processing and returns to the results to the originator (Leishman, 1999).

(1) Selected readings on Information Management

(2) Two Doctoral dissertations, two theses, a GAO report, and Gartner Group Inc. Study: Shaping CIO Agendas in an 'E' World

(3) Recent Practice Literature on the Role of the CIO

(4) The Skills, Knowledge, and Attributes for the CIO from the U. S. Department of Labor: Bureau of Labor Statistics Office Website.

(5) Personal interviews with selected Chief Information Officers.

E. BENEFITS OF THE STUDY/ORGANIZATION OF THE THESIS

This thesis contributes to the discussion on the need to evaluate the creation of a Chief Information Integration Officer for every command. The need is based on the perceived lack of organizational leadership in the management of information and technology that enables information to be disseminated to and from the lowest levels within most commands.

This evaluation presents a conceptual framework for the CI^2O identifying the knowledge, skill, traits and organizational makeup for the Information Management organization and recommendations on how to use the position effectively.

In order to provide a foundation for looking at the position in a command setting, Chapter I and Chapter II describe the past and present in the Navy and the world of information management and technology. Chapter III discusses the Methodology used for the analysis and introduces the research material used to build a composite of the CI^2O role. Then Chapter IV will present the findings

from the studies in Chapter III. Chapter V will provide the contributions to the CI^2O's position. Chapter VI will address the findings and their implications to the Navy and provide recommendations for further research.

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II. LITERATURE REVIEW

A. BACKGROUND

This chapter provides the background on the CIO. Beginning with the history of the CIO, legislation and guidance for the definition of the CIO from government and private sector, a brief discussion on the professional and credentialing organizations followed by the perceptions of the ineffectiveness of some CIOs. Ending the Chapter with the environment of IT in government.

1. The History of the Chief Information Officer Title

The CIO position was created to provide overarching leadership for the integration of technology. The role and responsibilities assigned to CIO in different industries vary, however regardless of sector, there is a shared expectation that the CIO will provide leadership to facilitate the effective implementation of Information Management and Technology. The evolution and responsibilities of the CIO position as well as the institutional expectations are described below.

a) Evolution of the CIO Position

Synnott and Gruber first described the Chief Information Officer position in 1981. Also the recognition of the strategic value of information in the Healthcare industry led to the development of new responsibilities for the senior IS executive. These responsibilities also led to a new title of Chief Information Officer, which also appeared in the literature in 1981 (Frenzel).

Synott and Gruber (1981) defined the CIO as "a senior executive responsible for establishing corporate information policy, standards, and management control over all corporate information resources."

The evolution of the Chief Information Officer position has been linked to the influence of information resource management philosophy (IRM.) IRM is " the planning, budgeting, organizing, directing, training, promoting, controlling and other managerial activities involved in the collection, use and dissemination of information" (Horton, 1982). Synott and Gruber (1981) argued that the position of Chief Information Officer was an essential component of information resource management.

It should be noted that little scholarly research has been done on the position of the Chief Information Officer. Although there are numerous reports and proprietary studies that focus on business CIOs. Many rely heavily on surveys conducted with small samples and their incomplete descriptions of the sampling process make it difficult to compare the results. However despite these limitations, the reports do help illuminate the issues as well as profile CIOs and their organizational responsibilities.

The history of the comptroller controlling the computer executives go back to the 1950s and 60s when computers were a finance department monopoly. But starting in the 1970s the computer executive started to emerge from under the comptroller's grasp. The computer executive began a quest to

be identified as an independent entity and as a peer in the hierarchy with marketing, manufacturing, personnel and operations. According the Strassman (1995), the CIO's equality was gained when their budget was sufficiently large enough to place them in the top ten spenders in the organization.

CIOs over the next ten years were starting to improve upon their image from an era of providing services from the direction or supervision of the comptrollers. The trust of their peers and customers was won from being responsive to their needs. CIOs became respected members of the management team when they no longer took advantage of their monopolistic position to extract funds from their customer's budgets to embark upon extravagant ventures.

Going into the 1980s, the economics of the CIO's empires, combined with the long political history of untrustworthiness made it easy for operating executives to break the back of the CIO and force them back into a more subservient role. Computers had now become an integral part of business and could not be left to the computer establishment alone (Strassman, 1995).

For the business world, the 1970s and 1980s were decades marked by a convergence of computing and communications technologies, and explosive growth in available data, and increased investments in information technologies. Consequently, for many companies, information technology became a strategic resource that was perceived as vital to the realization of organizational missions

(Porter & Millar, 1985). Information Resource Management (IRM)[20] was developed during this period. Its introduction shifted the focus of technology management from its historical emphasis on operations to a more strategic view that linked technology with organizational visions and objectives (Lytle, 1988; Marchand, 1985; Ray, 1986). This change led many organizations to seek a level of executive leadership not typically associated with existing computer personnel.

B. GUIDANCE FOR THE CIO POSITION

1. Definition of the Chief Information Officer

The following definitions are a representative sample from various organizations across government and the private sectors. These are first attempts at defining the CIO. These definitions all have the same common core elements in their definitions for the CIO.

a) Clinger-Cohen Act (1996)

The Clinger-Cohen Act mandates that government agency heads appoint a CIO, who reports directly to the agency head. The government CIO is to have information resource Management (IRM) as his official primary duty, "monitor the performance of IT programs for the agency, evaluate the performance of those programs on the basis of applicable performance measures

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[20] Information Resource Management: IRM includes the management of (1) the broad range of information resources, e.g., printed materials, electronic information, and microforms, (2) the various technologies and equipment that manipulate these resources, and (3) the people who generate, organize, and disseminate those resources. Overall the intent of IRM is to increase the usefulness of government information both to the government and to the public.

and advise the head of the agency regarding whether to continue, modify or terminate a program or project." (ITMRA, 1996) The CIO must promulgate and gain support for a strategic plan which establishes performance goals in objective, quantifiable and measurable form, establishes performance indicators to be used in measuring relevant outputs, provides a basis for comparing results with performance goals, and describes the means to verify and validate measured goals.

Other responsibilities include providing advice and assistance to the agency head and other senior managers on the acquisition of IT and management of information resources and developing and maintaining an integrated IT architecture for the agency. The CIO must also establish and assess the requirements for agency personnel regarding their knowledge and skills in IRM and in facilitating the achievement of performance goals established for IRM. The CIO must also assess how the positions and personnel at the executive and management levels of the organization are meeting those requirements and develop plans for hiring, training and professional development of personnel (ITRMA, 1996). The following definition is an example of a government agency's (NASA) definition and implementation of the Clinger-Cohen Act.

b) NASA

NASA's definition is an example of a government agency's implementation of the Clinger-Cohen Act core competencies for the role of the CIO. The CIO is an executive-level manager who's primary responsibility is Information Resource Management, who reports directly to the NASA Administrator on information and technology management issues, initiatives, and progress. The CIO is a peer of the Chief Scientist and the Chief Engineer and is positioned above the center Directors and Associate Administrators—heads of the various NASA field and headquarters offices—to promote leadership and authority for agencywide IRM (GAO/AIMD-96-78).

It is interesting to note that NASA was the first federal agency to assign a CIO just prior to the passing of the Clinger-Cohen Act legislation (GAO/AIMD-96-78). Specific Responsibilities include:

- Developing a high-level approach to planning and managing IT investments to support mission priorities;
- Providing broad oversight of information systems and processes across the agency;
- Leading in planning and coordinating the acquisition of information resources to carry out cross functional programs;

- Establishing and monitoring agency wide use of general information technology policies, architectures, and standards to achieve interoperability, interconnectivity, and security in IRM; and
- Assisting program organizations in planning and implementing their IRM activities.

c) Private Industry

Stephens, Ledbettter, Mitra & Ford (1992) credit Synott & Gruber (1981) with first using the term 'Chief Information Officer' and defining a CIO as "A senior executive responsible for establishing corporate information policy, standards, and management control over all corporate information resources." More recently, and to reflect the functional boundary spanning role of the contemporary senior IT executive in an organization, the CIO has been defined as "the highest-ranking IS executive who typically exhibits managerial roles requiring effective communication with top management, a broad corporate perspective in managing information resources, influence on organizational strategy, and responsibility for the planning of IT to cope with a firm's competitive environment" (Grover, et al, 1993).

d) Education

The CIO position in higher education was created to provide overarching leadership for the integration of technology in colleges and

universities. The role is defined as the senior executive responsible for establishing institutional information policy, standards and management control over all or most information resources, including some or all of the following: academic computing, administrative systems, libraries, library computing, and telecommunications (Woodsworth, 1991).

e) Civilian Medical

The CIO's management responsibilities can be extensive, particularly when the organization is large and complex. Through taking a consistent view of the organization's long-term information management requirements, in conjunction with immediate requirements and constraints, the CIO must develop a comprehensive IT strategy and set of services. Typical medical CIO responsibilities include:

- Active executive team membership, leadership, financial, strategic, and operational responsibilities
- Implement enterprise-wide information system management, either through line control with affiliated facility or entity (home health, managed care, medical service organization/physician-hospital organization) IS department managers as direct reports, or as a corporate-level facilitator of IS planning and management.

- Develop an information technology planning strategy, including future trend analysis and forecasting, technology scanning and adaptation analysis capital allocation and budgeting and when applicable, alpha or beta site development responsibilities.
- Implementation and operations of IS (in an oversight role)
- Implementation of telecommunications and network operations (in an oversight role).
- Provide management education (of IT's relevance to business and medical service objectives, including the potentials of new and emerging technologies).
- Provide oversight for general management (may hold responsibility for other groups within the organization such as medial records, decision support, management engineering, or patient accounting that deal routinely with large amounts of data and information) (Deluca & Cagan, 1996).

f) Gartner Group Inc.

CIOs develop the IT vision for the corporation. They oversee the development of corporate standards and technology architecture, technology evaluation and transfer; sponsor the business technology planning process;

manage client relations; align IT with the business; and develop IT financial management systems. The CIO must also oversee plans to reinvest in the IT infrastructure, as well as in business and technology professionals. The CIO is responsible for leading the development of an IT governance framework that will define the working relationship and sharing of IT components between various IT groups within the corporation. Extensive knowledge of IT, general and financial management, as well as strong leadership skills are needed (GartnerGroup, 2000).

g) United States Department of Labor: Bureau of Labor Statistics

The Bureau of Labor Statistic's (BLS) description of the computer and information systems managers job includes planning, coordinating, and directing research, design, production and computer-related activities. They may supervise engineers scientists, technicians, computer specialists, and information technology workers, along with support personnel.

These managers use advanced technical knowledge of computer and information systems to oversee a variety of activities. They determine scientific and technical goals within broad outlines provided by top management. These goals may include the redesigning of an aircraft, improvements in manufacturing processes, the development of large computer networks, or advances in scientific research. Managers make detailed plans for the

accomplishment of these goals...for example working with their staff they may develop the overall concepts of a new product or identify technical problems standing in the way of project completion. Another role of computer and information systems managers is to direct the work of systems analysts, computer programmers, and other computer related workers. These managers plan and coordinate activities such as installation and upgrading of hardware and software; programming and systems design.

2. Professional Organizations and Credentialing

There are a number of organizations or associations that represent the CIO but due to the length a focus of the thesis the author will only talk about two of the larger professional organizations. They are the Society for Information Management (SIM) and College of Healthcare Information Management Executives (CHIME).

The Society for Information Management (SIM) is a global not-for-profit organization established in 1968 and made up of over 2700 IT and executives who are corporate and division heads of IT organizations, their management staff, leading academicians, consultants and others. SIM's mission is to "provide international leadership and education in the successful management and use of IT to achieve business objectives" (SIM, 2000). It does this through active local chapters all over the U.S. and in Italy and Korea and through its on-line

discussion groups and database resources available on their website. SIM does not have a credentialing mechanism (SIM, 2000).

College of Healthcare Information Management Executives (CHIME) is the major professional organization for medical CIOs. It was formed in 1992 as an adjunct of the Health Information Management Systems Society to serve as the further professional development needs of healthcare CIOs and to increase the effective use of information management within Healthcare. CHIME's mission is to serve the professional development needs of health care CIOs and to advocate the more effective use of information management within healthcare to improve healthcare delivery. From an initial membership of 250 members in 1992, CHIME has grown to a membership of 600. It offers spring and fall CIO forums, a one week Information Management Executive (IME) course twice each year, a yearly emerging technology course, a searchable database available on its website and a fax back document service for reference documents. The college has a close collaborative relationship with Healthcare Information System's vendor and consulting community; CHIME does not have any formal credentialing mechanism (CHIME, 2000). CHIME as developed an alliance with the American Health Information Management Association (AHIMA) and the American Medical Informatics Association (AMIA) to form the Joint Healthcare Information Technology Alliance (JHITA). The intent is to pursue a wide variety of objectives related to the common good of the JHITA members. Their main

focus is to monitor the national and regulatory activities and report back to their members with routine summaries. A second charge is to develop a senior education task force to for healthcare information management and technology healthcare leadership (CHIME, 2000).

DoD offers a CIO certificate course through the Information Resources Management College (IRMC). It is affiliated with National Defense University, which focuses on professional military education. IRMC develops its course material inline with Clinger-Cohen Act core competencies. To obtain the certificate a student must complete eight, five-day courses or be a member of the Advanced Management Program supplemented by a lesser number of courses, depending on the track. The student then must complete two more courses from the primary or enrichment listings for any subject area. All students must successfully complete the subject areas of Policy and Performance and Results-Based Management to receive their completion certificate. The student must also complete four more subject areas through primary course offerings (IRMC, 2000).

To be eligible for the curriculum, civilian members must be in the grade of GS/GM 13-15 and military members in the paygrade O5-O6 and possess a bachelor's degree. IRMC considers waiver requests for applicants within one paygrade level of the required grade. IRMC teaches all courses at the graduate level and includes student assessments to achieve academic rigor. The student

assessments take various forms from individual papers and projects to team projects and presentations. Instructors teach principally in seminar format. Lectures, guest speakers, and field studies supplement the seminars. The IRMC awards a completion certificate when a student completes the required courses. The DoD CIO sponsors the program (IRMC, 2000).

The above guidance provides examples of governments and the privates sector's definitions of CIO's. Most organizations have people performing in the role or position described as the CIO. However, there appears to be a perception of ineffectiveness in some of those CIO's. The next section will present some background on these perceptions.

3. Lack of Skilled People in the CIO Position

With the growing awareness of the strategic asset of information and the need to manage the technology better many organizations have created the position of the CIO. (Gillespie, 2000, O'Riordan, 1987; Stephens, Ledbetter, Mitra & Ford, 1992; Applegate & Elam, 1992; Grover, Jeong, Kettinger & Lee, 1993).

There is a plethora of practice literature questioning the effectiveness and relevancy of the CIO. The literature leads one to believe that that this new executive may be experiencing some problems performing up to expectations. For example, titles that illustrate the general perception that CIOs are possibly not performing up to par: "Chasm Closer: the CIO/CEO Gap Still Dogs

Information Systems" (King, 1995); "Hatred: an update on CIO/CEO Relationships" (Klug, 1996); "The Missing Piece" (Field, 1996).

The Harvard Business review recently published a four-section article "Are CIOs Obsolete?" The author's articles discuss the aspects of the computer revolution and the assignment of the Chief Information Officer as the possible designated savior. Although, several articles published portray that the CIO has lost the battle with information technology. The four authors discuss that is not the case for the CIO. The CIO must regain ground by becoming more than a technologist but a business minded executive with customer focus. Dawn Lepore (2000), CIO and vice chairman of Charles Schwab in San Francisco, stated, "The misunderstanding is, to a great extent, justified. The title still means so many different things to so many different companies". Lepore (2000) gives examples of CIOs that are simply department managers who ensure that all the PCs can be turned on and that the processors work while others are charged with managing a company's Web-site development and maintenance-in relative isolation or in tandem with the marketing department. Michael J. Earl (2000), Professor of Information Management at London Business School, discusses in the article that every few years, it seems, that the role of the CIO becomes an agenda issue... "Should it be reinvented? Should it survive? Sometimes the attention is sparked by the sub par performance of corporate IT functions." Another side of this story of the CIO is that the context in which he/she operates is becoming more

complex. Information technologies continue to multiply and are now as much like consumer electronics as industrial technologies. The CIO's role has never been well defined, what isn't clear is whether there will ever be a general, boilerplate description of the position. Many companies still see the CIO as a technologist and not a business executive but expect more from them (Thomas, 2000). Peter McAteer (2000), Vice President and Managing Director of Giga Information Group's strategy, organization and workforce-planning e-practices in Norwell, Massachusetts, and Jeffrey Elton, managing principal of Integral, a management consultancy in Cambridge, Massachusetts, state, "Some CIOs will founder in their newly expanded roles. These people are likely to be technologists." The articles presented in this section supports the majority of the practitioner literature that suggests the struggle in the CIOs role is a matter of personnel filling the role or moving up without the formal education in business process and customer focus.

4. Current Government Environment

A number of legislative and guidance documents on the effective investment and implementation of information technology and the cost of maintaining quality people have been published. The documents are distributed but the increase in efficiency and reduction of cost has not shown the return on investment expected. One explanation is that in the ever-increasing technology revolution the government is feeling the crunch from the lack of skilled people.

This increase in technology and the lack of skilled labor has lead to the current situation that government agencies are now facing.

The Deputy Undersecretary for Acquisition stated, "Our workforce is diminishing 50% in the next few years due to retirement and other factors." He also stated "We need to build the next generation of professionals in the Defense Department with these skills. But how many IT people are we going to have in the government" (Messmer, 2000)? The Navy brings its own unique set of limitations when trying to meet the demand as to competing with private industry and salaries are just one of many constraints. One such government organization, the National Security Agency, is in the process of soliciting bids from five contractors to take over their technology infrastructure (Messmer, 2000). Another major barrier for retention and or recruitment is the complexity of the Navy's procurement process. The procurement process is cumbersome and causes technologies to be outdated before they can be implemented. The answers to these problems are not easy ones. Some think the answer "is to outsource IT" as written in a Federal Computer Week article written by Messmer quoting Paul Brubaker, Deputy Chief Information Officer in the Office of the Assistant Secretary of Defense (Messmer, 2000). This thesis contents that before outsourcing can benefit the Navy each command needs a firm understanding exactly what information management is and its technology costs through detailed information flow requirements study throughout the

organization. To accomplish the task of identifying the requirements of IT an IM professional or body of IM professionals is required. There are professionals stepping up to the IM/IT challenge, but they are not as effective as they could be if they had the skills and knowledge that the position demands.

There is a debate amongst the executives in power as to allowing the Chief Information officer a seat with the executive committee. To earn a seat at the executive table the Chief Information Officer needs to display proactive sound business and technological strategic thinking and decision-making (ITAA, 2000). One must show the need for such a position and then command the respect at the organizational level that is appropriate. In addition, the CIO role demands that the individual exhibit a breadth of knowledge about the business and organization in which they work. An analyst at Gartner Group Inc. who stated "CIOs are one of the few groups of executives who have a real 'Helicopter' view of the enterprise, and their executive colleagues are now realizing how valuable that is" (Broadbent, 2000). Today's IM executive must be proactive in understanding the strategic and operational potentials of information technology (IT). In addition to providing oversight leadership and governance, information management (IM) executives must understand the roles and responsibilities of their internal customers in sufficient detail to assist in problem solving and prevention.

An area where the current CIOs have expressed their most disliked region as an executive is dealing with the customer (Hurd, 2000). Although, most of the practice literature suggests that the human capital is one of the most important areas that the CIO needs to develop to be successful (Polansky, 2000; Heller, 2000; & Cross, 2000). Other CIOs state that winning the support of the user is one of the most important steps to a successful project (McDougall & McGee, 1999). This non-technical perspective, based on a solid application of organizational structure, function and behavior disciplines, is essential to ensure that the IM/IT function serves the organization effectively and efficiently, with maximum return-on-investment (ROI) benefit (Baldwin, 2000). Effective IM/IT oversight not only considers the role it plays within the business organization, it also examines the structure of the information management (IM) organization and the external environment in which it operates. The size, organization, and functional responsibility of IM organization varies according to the nature and objectives of the business or industry it supports. In any case, the IM organization must have appropriate management staff and skills to succeed in making IT an effective tool for the entire organization.

It is important to note that the need for a person to coordinate all IM/IT activities is critical to the success in this rapidly changing information world (ITMRA, 1996). The leadership of a Federal CIO down to the command level CIO is needed to transform the legacy systems and manual systems to

government agencies and military services into a "Digital Nervous System"(Gates, 1999). If there is not a knowledgeable body of leaders with this shared vision then the efforts of the many agencies that make up these organizations and the government will continue to develop "stovepiped"[21] systems and research and develop in vacuums[22]. It is widely perceived that the stovepipe mentality costs the government and private industry million's of dollars in inefficiencies each year.

Information and its flow is what make an organization function (Strassman, 1995). But, without timely and quality information, the mechanical and human components will continue to work but not at their optimum level. What are the requirements for a leader that is capable of succeeding in this future environment of information management? The Chief Information Integration Officer (CI^2O) is that professional.

C. METHODOLOGY

A matrix framework was developed to synthesize the results from the research models. The results of the studies are presented in Chapter IV and discussed along with a summary of the research findings in Chapter V. The conclusions reached and recommendations are provided in Chapter VI.

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[21] Stovepiped: "stovepipe" mentality, is where there is little regard for any of the disciplines one was not familiar with, or systems that do not share information with other systems except in a vertical fashion (DOE site).

[22] Vacuums: Creating systems without interaction from those outside the area of responsibility (TechWeb).

This research is a two-phase approach to explore the different models of defining the Chief information Officer's role and responsibilities. The basis for the research was established through an extensive review of the literature concerning the Chief Information Officer's role.

Based on the literature review, the First Phase of research involved the identification of existing studies, which presented models for the CIO in government and private organizations. Background information presented in Chapters I and II identified the need for a clearly defined, professional CIO in Navy commands. A summary for each studies used in this thesis are located in Chapter III. Second Phase: The findings of the studies used in the analysis are presented in Chapter IV for the comparison and analysis. The analysis consisted of assessing the similarities and differences among the study results identified from the government and private sectors.

D. RESEARCH QUESTIONS

The primary research questions this thesis answers include:

- What are the responsibilities of the Chief Information Officer?
- What are the core competencies of the Chief Information Officer?
- What are the skills needed to be a Chief Information Officer?

E. SUMMARY

This chapter reviewed the history and guidance in regards to the definition of the of Chief Information Officer, the professional and credentialing

organizations, Lack of skilled people and the problems explain in several examples from a variety of government and the private sector organizations, and finally the current government environment. The background and literature review areas presented in Chapters I and II provide the framework for the reader to analyze the cases to be presented in Chapter III and their relevance to the thesis questions presented in this chapter. From this review the construct of the analysis is set to answer the thesis questions. The findings are for the studies are located in Chapter IV.

III. DESCRIPTION OF STUDIES

The studies presented in this section are a result of a literature research for studies conducted on the CIO and his/her role and responsibilities. These studies cover the Government and the private sector. The intent this chapter is to present the background information on the study, their methodology and models used their philosophy.

A. RESEARCH STUDIES DISCUSSION

1. Government Accounting Office Report: Implementing Effective CIO Organizations

a) Overview

This report was prepared under the direction of David L. McClure, Associate Director, Governmentwide and Defense Information Systems at the Government Accounting Office. The study is based on the best practices of prominent private and state government organizations. The report evaluated ways that the federal government could learn from the best practices of the agencies studied. The report also focuses on the need to integrate the CIO function fully into overall performance-based and accountability management.

If Chief Information Officers are to succeed, they must gain status and support among the agency administration, government and industry officials. In the four years since the 1996 Clinger-Cohen Act created the federal CIO, some agencies have done better than others in shaping the CIO position and its

place within the agency (GAO/AIMD-00-128). Although many CIOs have established a higher level of credibility within their agency, they often are not at the top level of the management structure and do not have the full support of the rest of the organization's leadership. (GAO/AIMD-00-128)

The success of the CIO heavily depends on the senior management understanding the role of the CIO within the organization. McClure stated that, "Agency leaders must help facilitate success in the IT arena. CIOs are critical, but they cannot do it alone." Mr. Flyzik, CIO at the Treasury Department and vice chairman of the Government CIO Council, stated that "If CIOs are to be held responsible and accountable for results, they will need the authority to influence resource decisions" (Frank, 2000).

b) Objectives

The objective of the research was to conduct a study of how several leading organizations have implemented their CIO positions and supporting management infrastructures. The study looked for effective CIO management practices across a variety of organization types and structures. Using this information along with case studies developed from the companies interviewed the suggested guidance in *Implementing Effective CIO Organizations* was created.

c) Scope

There was a great deal research conducted on the CIO organizations in the effort to provide information on their effective practices in IM. The knowledge gained from this literature review makes up the groundwork for the design of the guide, *Maximizing the Success of the Chief Information Officer*. These case studies were developed from the private and public organizations. The case studies help in the development of the interview framework, emphasizing the practices and principles identified.

d) Methodology for the Study

The selection of organizations was based on awards, recognition from professional organizations and publications over the past several years. Multi-day visits were arranged with each organization that agreed to the study. The following were areas of concentration during these visits:

- Each organization's approach to selecting, positioning, and defining the roles and responsibilities of its CIO;
- Techniques for instituting IT policies and standards, managing technical personnel and financial resources, building customer/supplier relationships, and measuring the performance of IT organizations in meeting business needs; and

- Strategies for promoting and facilitating business and organizational change through IT.

The researchers visited three private and three public sector organizations meeting the criteria stated above. The private organizations were selected based on recognitions by professional organizations and publications, corporate executives, or independent researchers. The state organizations selection was based on recognition by professional publications, state CIOs, and the National Association of State Information Resource Executives (NASIRE). The organizations that participated in the study:

- Commonwealth of Pennsylvania
- State of Texas,
- State of Washington,
- Chase Manhattan Bank
- General Motors Corporation, and
- J.C. Penny.

The former CIO from the State of California and the current CIO at U.S. West Communications were also interviewed but no comprehensive case study was conducted with these institutions (GAO/AIMD-00-128).

The site visits were used to talk with senior executives, IT managers and other officials identified by the hosting site to gain their perspectives on the information and technology management issues. The visits

were also used to collect documentation, illustrations and examples of their practices in information management. The information gathered was used to compare the practices across the different organizations participating in the study to look for common best practices.

Approximately fifty percent of the Federal CIO Council members were interviewed during the course of the study. Their interviews were used as a comparison and validation of the practices in both the private and state organizations to ensure they matched the challenges that federal IM organizations faced. The results of the interviews and reviews with five federal agencies' CIOs are documented in a section of the report called the "Current Federal CIO Environment." The interaction with these five CIOs enabled the researchers to pinpoint areas where federal agencies could benefit from integrating the best practices of leading organizations (GAO/AIMD-00-128). The findings from the study will be presented in chapter IV as part of the analysis.

2. Antecedents of CIO Effectiveness: A Role-Based Perspective

a) Overview

The author of Antecedents of CIO Effectiveness: A Role Based Perspective, Detlev H. Smaltz, PhD of Philosophy, conducted a field study of one hundred and six organizations investigating the antecedents of Chief Information Officer's (CIO) effectiveness in the context information intensive industry - the

healthcare services industry. Smaltz (1999) used his previous research to specify two key antecedents of CIO effectiveness: CIO capability and CIO engagements[23]. The relationship between CIO capability and CIO effectiveness, as well as, the relationship between top management team/CIO engagements and CIO effectiveness was each posited to be moderated by the organization's strategic vision of IT.

Data were collected from several of CIO and Top Management Team (TMT) members. Using a multidimensional, role-based measure of CIO effectiveness and the analytical technique of partial least squares estimation, the research model explained 66% of the variance in CIO effectiveness. As predicted by Smaltz (1999), CIO capability (i.e., the ClO's strategic business knowledge, the ClO's strategic IT knowledge, the ClO's political savvy, and the ClO's interpersonal communication skill) created a significant relationship with CIO effectiveness. In addition, TMT/CIO engagements exhibited a significant relationship with CIO capability. While no direct effect of CIO engagements on CIO effectiveness was found in this study, evidence suggests that TMT/CIO engagements and CIO capability assert a supportive effect on CIO effectiveness. In addition, some evidence suggests that CIO capability may mediate the relationship between TMT/CIO engagements and CIO effectiveness. Smaltz's research showed no moderating result of an organization's strategic vision of IT on the main relationships in model.

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[23] Engagement: sharing the activities of a group; "the CEO tried to increase his executive's engagement in business

The number articles focusing on the fate of CIOs and their perceived ineffectiveness provided the motivation Smaltz's study. What factors contribute to a CIO's effectiveness within his/her organization? Are personal attributes or skills solely responsible for CIO effectiveness or are their other organizational factors that contribute to CIO effectiveness?

b) Dissertation Questions

Smaltz (1999) focused on the factors that affect CIO effectiveness. The specific research questions include:

- How does a CIO's knowledge and interpersonal skill affect CIO effectiveness?
- How do engagements between top management team members and the CIO affect CIO effectiveness?
- What is the nature of the relationship between a CIO's knowledge and interpersonal skill and CIO engagements?
- How does an organization's strategic vision of IT moderate the relationships between a CIO's knowledge and interpersonal skill, CIO engagements, and CIO effectiveness?

c) Objective

The purpose of this study is to examine the effects of 1) business related and strategic IT related knowledge and interpersonal skill of the CIO and 2) Interactions between the CIO and top management team members (TMT) on

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activities".

CIO effectiveness. The combination of business related knowledge, IT strategic related knowledge and interpersonal skill are referred to here as CIO capability. The interactions between the CIO and the TMT are referred to as CIO engagements. The hypothesis for this study was that both CIO capability and CIO engagements are important factors that contribute to CIO effectiveness. In addition, the author proposed that the impact of CIO capabilities and CIO engagements' in regards to CIO effectiveness depends on an organization's strategic vision of IT.

d) Methodology

Smaltz (1999) used the ClO data from his 1998 study to find six distinct and specific roles that are effective for healthcare CIOs. - IT educator, IT contracts oversight, classic IT support/utility provider, integrator, informaticist/IT strategist and business partner/strategist. Figure 3.1 below presents the results of his findings.

In addition to finding six distinct ClO organizational roles within the healthcare industry, Smaltz (1998) also discovered that a host of organizational contextual factors impact on the relative importance of the different ClO roles. For instance, he noticed that the extent of a ClO's internal networking activities,

CIO membership on the TMT, an organization's tax status (i.e., for-profit, not-for-profit), and system affiliation (i.e., independent organizations as opposed to multi-entity organizations) all displayed a significant impact on the

relative importance of the six CIO role expectations. Smaltz indicates that the evidence of networking activities impacting relationships provides additional support to the notion an investigation of CIO effectiveness take into account all the CIO roles pertinent in his/her respective organization.

Role Factor	Description
IT Educator	This role is concerned with ensuring that the human foundations for innovation are in place. In this role the CIO is: 1) a champion for computer literacy throughout the organization, 2) among TMT members, and 3) a conduit of insight into the value of current and emerging technology.
IT Contract Oversight	This role is concerned with ensuring that strategic partnerships with external vendors are optimized. In this role the CIO: 1) negotiates new contacts with external vendors/partners; 2) accomplishes executive contract management and oversight and 3) interacts often with non-IT managers throughout the organization to ensure these contracts are meeting business unit needs.
Classic IT Support/Utility Provider	This role is the classic IT support role ensuring that the IT unit is operationally efficient and effective. In this role the CIO ensures that 1) the IT unit is responsive to customer needs; 2) network to facilitate intra-organizational communication, and 3) that the organization's users have adequate information tools with which to effectively do their jobs.
Integrator	This role is concerned with developing value-added integration among and between business units as well as with external partners. In this role the CIO: 1) directs efforts to build an integrated delivery system, 2) implements the computer-based patient record, 3) migrates the organization from legacy stand-alone applications to cross-department integrated applications, and 4) seeks to develop a thorough understanding of the healthcare delivery process.
Informaticist/ IT Strategist	This role is concerned with developing sound data management and IT plans and processes. In this role the CIO ensures that: 1) organizational data is secure and confidential, 2) that organizational data is highly accurate, 3) that senior managers and department managers are provided with metrics that shows the value of the IT, 4) an information systems plan that aligns with the business is in place and 5) the builder and maintainer of a change-ready staff.
Business Partner/ Strategist	This role is concerned with issues relating to the greater organization outside of the IT unit. In this role the CIO: 1) helps to shape the organizations overall mission and vision, 2) is heavily involved in overall business strategic planning and decisions, 3) provides expertise on multi-disciplinary BPI teams, and 4) directs IT-enabled BPR.

Figure 3.1 Smaltz's (1999) Six CIO Roles

Smaltz's study was primarily based on Armstrong's (1995) and Armstrong & Sarnbamurthy's (1999) work. The construct of the TMT's strategic vision of IT was proposed as a moderator to both the CIO antecedent-dependent variable relationships. The full conceptual model that guided this research is depicted in Figure 3.2.

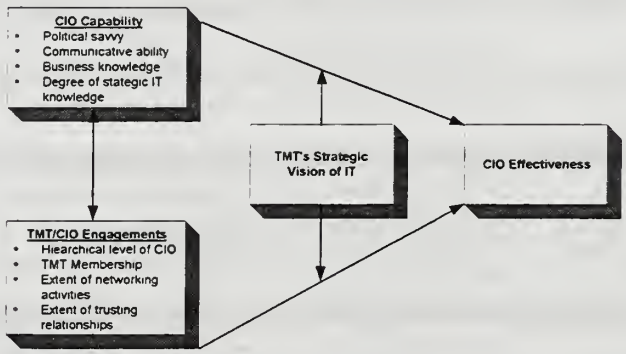


Figure 3.2 Smaltz's (1999) Conceptual Model

The research consisted of a two survey instruments used to collect data in this study - a CIO questionnaire and a TMT questionnaire. Stage one of the survey process included three approaches; a in-person interview, at the Healthcare Information Management Systems Society (HIMSS) conference in 1998, another was through U.S. mail services, and the last was through e-mail. Both the mail and e-mail participants were selected through HIMSS 1997/98 member directory. The second stage consisted in surveys being mailed and/or personal phone contacts with the respondent CIO's top management team members (CEO, COO, and/or CFO). This part of the survey process was used to evaluate the interaction with TMT and the CIO to measure their effectiveness in

the job. The introduction of constructs in Smaltz's research model is presented in Figure 3.3. The constructs are presented in the following order: 1) CIO effectiveness, 2) CIO capability, 3) CIO engagements and 4) strategic vision of IT.

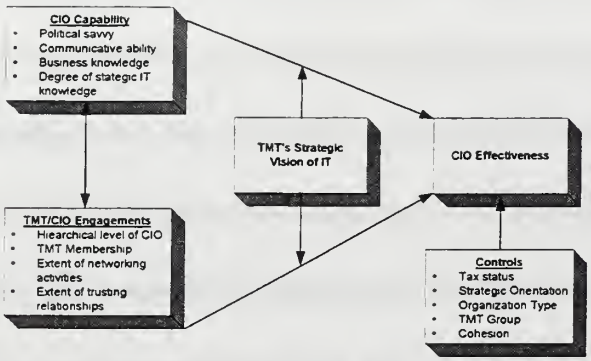
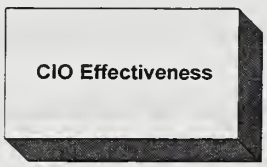


Figure 3.3 Smaltz's (1999) Research Model



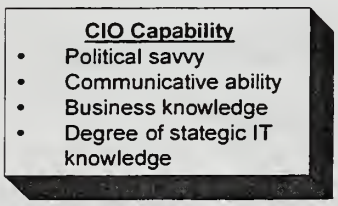
(1) CIO Effectiveness. Defined as the CIOs performance, as assessed by the CEO and other members of the TMT, within their role as CIO of a particular organization. Smaltz (1999) mentions the importance of including a role component in measurements of employee performance as suggested in studies by Welbourne et al. (1998).

Smaltz (1998), used Welbourne's REPS (role-based performance scale) and the information in his study to develop six distinct roles that are functional for healthcare CIOs. The healthcare CIO roles that Smaltz

(1998) created through a factor analysis in his previous study of 168 healthcare CIOs were: business partner/strategist, IT contract oversight, integrator, informaticist/IT strategist, IT educator, and classic IT support/utility provider.

The process Smaltz (1998) used in the creation of these CIO roles included; an interview with three healthcare CIOs and three healthcare TMT members, each at different organizations, to develop the list of 25 role items that were then factored into the role dimensions. Smaltz's dissertation used his 25 role items and asked TMT members to rate the effectiveness of their respective CIO in meeting the individual role expectations on a five point Likert scale ranging from 'outstanding' to 'not meeting expectation'.

Instead of using a single overall measure of CIO effectiveness, a multi-dimensional effectiveness measure was used by computing the average performance rating of the items that make up each of the six healthcare CIO roles in Figure 3.1 above. The six effectiveness ratings were then used as reflective indicators of CIO effectiveness in a structural equation model.



(2) CIO Capability. Defined by Smaltz (1999) as the knowledge and interpersonal skill of the CIO to include: Degree of political savvy

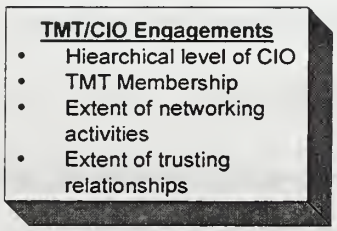
was evaluated by asking the TMT members to assess the CIO's ability to: 1) accurately read potentially contentious situations, 2) act with tact when confronted with potentially contentious situations, and 3) develop good rapport with most people.

Interpersonal communicative ability was assessed by the TMT to answering question about the CIO's ability to 1) use non-technical terms when making presentations to the TMT, 2) use business terms familiar to the other members on the TMT, 3) use clinical terms when making presentations to clinical business units. The assessment is on a five-point Likert scale ranging from 'extremely effective' to 'not effective at all'.

Assessing the degree of strategic IT knowledge was answered by TMT members rating the CIO's knowledge regarding how 1) other organizations like their own are applying IT, 2) to utilize existing organizational IT assets to address current needs, 3) to identify relevant emerging technologies to support the organization, and 4) to guide the organizations IT acquisition decisions. A 5-point Likert scale was used to assess the CIO's level of Strategic IT knowledge ranging from 'very well informed' to 'not informed'.

The evaluation of the degree of strategic business knowledge was conducted through questions asked of the TMT members assessing the CIO's personal knowledge of the organization's present and future products (services), markets and business processes, and on the organization's

basis of competition. A five point Likert scale was used ranging from 'very well informed' to 'not informed'.



(3) TMT/CIO Engagements. Data on TMT/CIO engagements were obtained by using both the CIO Questionnaire as well as the TMT Questionnaire. The items that made up the construct of the TMT/CIO engagements:

Hierarchical level of the CIO was achieved through a question asking how many reporting levels are between them and the CEO.

Formal membership in the TMT was measured through a two segment approach asking the TMT member whether or not the CIO was a formal member of the TMT, using a simple 'yes' or 'no' response. The second segment measured the extent of networking activities along two facets: formal, business related, interaction with the CEO and other members of the TMT. Data for this item was obtained by asking the CIO the average level of formal interaction they have with the CEO and the other members of the TMT. The data of this area was obtained by asking the CIOs the level, on average, of informal, social...non-business, interaction that they have with the CEO and the

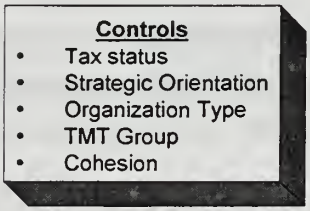
Strategic Vision of IT	Description
To Automate	The potential of IT is cost saving or quality improvement through automation. The role of IT is to replace expensive, unreliable human labor.
To informate up	The potential of IT is increased managerial control of the organization. The role of IT is to provide data and transactions that allow management more clear and organized views of the state and dynamics of the organization.
To informate down	The potential of IT is to empower employee driven performance improvements. The role of IT is to provide data and transactions that yield a comprehensive picture at the "operator" level, with members of the staff gaining greater insights into their own processes.
To transform	The potential of IT is to transform the organization. The role of IT is to fundamentally change the organization and/or industry through new healthcare products and services often including redefinition of relationships with the organization's customers and/or suppliers.

Figure 3.4 Smaltz's (1999) and Schein's (1992) Strategic Vision of IT Model

other members of the TMT. A five-point scale that ranged from 'daily' to 'once a year or less' was used for both areas.

Extent of trusting relationships were answered by asking TMT members to assess the level of trust they had with the CIO on the following dimensions: 1) to act in the TMT members best interest, 2) the level of positive affect towards the CIO, and 3) the dependability of the CIO in critical situations. A 5-point Likert scale was used ranging from 'strongly agree' to 'strongly disagree.

(4) Strategic Vision of IT. Smaltz followed Armstrong's (1995) procedure, strategic vision of IT as it was operationalized in the same manner as it was by Feeny et al. (1992) which was based on Schein's (1992) strategic IT vision scheme of automate, informate up, informate down and transform. The TMT member will be asked to articulate which best describes their TMT's present vision of the role of IT in Figure 3.4 in their organization.



(5) Control Variables. Information on tax status of responding organizations was collected at three levels: 1) for-profit, 2) not-for-profit, and 3) not-for-profit -government affiliated.

Strategic orientation was collected by asking TMT members what the dominant strategy of their organization was using Porter's strategic typology (1980) of 1) low cost provider of services, 2) differentiation, or 3) niche.

Organizational type was operationalized along the following dimensions: 1) teaching hospital, 2) clinic, 3) group practice, 4) non-teaching

hospital, 5) nursing home, 6) home healthcare agency, 7) corporate regional headquarters.

Group cohesion used a three item scale asking TMT members to assess the TMT and its members regarding 1) how well they get along together, 2) how well they help each other out, and 3) how well they resolve their differences.

The findings from the study will be presented in chapter IV as part of the final analysis.

3. Implementing Technology In Higher Education: The Leadership Role and Perspectives of the Chief Information Officer

a) Overview

The author of Implementing Technology in Higher Education: The Leadership Role and Perspectives of the Chief Information Officer, Nancy J. Becker, PhD of Education, States the purpose of her study was to examine the degree of cognitive complexity[24] that CIOs in colleges and universities bring to that role. A secondary goal sought to develop a current profile of the characteristics and responsibilities of CIOs. The study was based on the conceptual model developed by Bolman and Deal,[25] which synthesizes theories of

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[24] Cognitive complexity: The degree of differentiation of a individual's construct system. The tendency of a individual to construe social behavior in a multidimensional way. (A more cognitively complex individual has available a more versatile system for perceiving the cognitively complex person. A construct, which is intended to indicate something about how the individual, structures his/her world (Watson et al.).

[25] Bolman and Deal Model: the ability to invoke a multiframe perspective is critical for effective leadership (Bolman & Deal).

organizational leadership into four perspectives or frames: Structural, Human Resource, Political and Symbolic. The model will be described in the methodology section for this dissertation.

The methodology included a survey questionnaire, document analysis of job descriptions and curricula vitae mailed to CIOs identified through the CAUSE database, 131 participated in the final analysis. The questionnaire included Bolman and Deal's Leadership Orientations-Self (LO-S),[26] as well as biographic and demographic questions. Survey response rate was 64.5%. The mean age of the 109 males and 22 females was 50.6 years. Most report to their administrative vice-president of the university or college and are responsible for, in varying degrees, administrative and academic computing; planning and institutional research; media and television services; and copy/reprographic and mail services. Another data collection instrument was semi-structured telephone interviews of with 12 CIOs selected through a statistical process.

Frame use was assessed quantitatively using LO-S questions 1-32 (rating scale) and 33-38 (forced choice), and qualitatively, through content analysis of critical incidents recounted during the interviews. Comparison of the rating scale and forced choice responses revealed substantial inconsistencies, with only 42.7% ranking the same frame first in both question sets.

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[26] Leadership Orientations-Self (LO-S): Bolman and Deal's survey tool to assess multiframe leadership (Bolman & Deal1990).

Becker (1999) used analysis of variance (ANOVA) examining frame use in relation to age, gender, educational attainment, major field of study, and CIO and higher education experience. Significant relationships were found between gender and use of the structural and human resource frames, and major area of study and the structural frame. 27.5% of the survey respondents and 66.7% of the interviewed CIOs reported multiframe[27] leadership showed consistent use of three or more frames. Results were then compared to earlier research based on the Bolman and Deal Model.

Becker (1999) stated that although the convergent validity of LO-S needs further scrutiny, the Bolman and Deal model of leadership is sound. Judicious use of the four frames promotes leadership effectiveness. Becker (1999) suggests with her findings that higher education CIOs should develop more cognitively complex, broader and more dynamic, leadership perspectives.

Becker (1999) covered several areas to develop a deeper understanding of the leadership role and perspectives of the chief information officer. She states that it was relevant for the literature review to cover four main areas: 1) technology and higher education, 2) organizational leadership, 3) innovation and organizational change, 4) the Chief Information Officer. First, leadership in higher education to provide the context that supports the need for a multiframe CIO leadership. Second, to a review of the innovation and change

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[27] Multiframe thinking requires movement beyond narrow and mechanical thinking toward artistic thinking. This allows for more fluid expression of ideas in terms that are less precise, but more easily understood, felt, and appreciated by others (Bolman & Deal).

literature to help understand the complexities associated with the implementation process and the rationale for the chief information officer position. Third, draw from the literature business and education environments to provide a useful framework for understanding the evolution of the CIO role and its importance. Lastly, review and fully understand the challenges inherent to chief information officer's leadership and the relevance of the Bolman and Deal model and the organizational leadership literature.

b) Methodology

Becker's study is based on a qualitative and quantitative methodology and includes a survey instrument, semi-structured interviews, and document analysis. The survey instrument was sent to chief information officers in colleges and universities and was designed to elicit demographic and institutional data related to the CIO position that could be compared with results reported by Penrod et al. (1990) and Pitkin (1994). The survey also included Leadership Orientations (Self) designed by Bolman and Deal (1990) for leadership frame[28] analysis. Additionally, in order to address the limitations inherent to survey research, semi-structured interviews were used to provide an added level of data for analysis. Finally, CIOs were asked to supply a copy of their job description and a current curriculum vita for document analysis.

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[28] Bolman and Deal describe organizational theories in terms of what they call "frames." Their assertion that one sees organizations simultaneously as machine, family, jungle, and theater are metaphors of these frames--respectively labeled Structural, Human Resource, Political, and Symbolic (Becker, 1999).

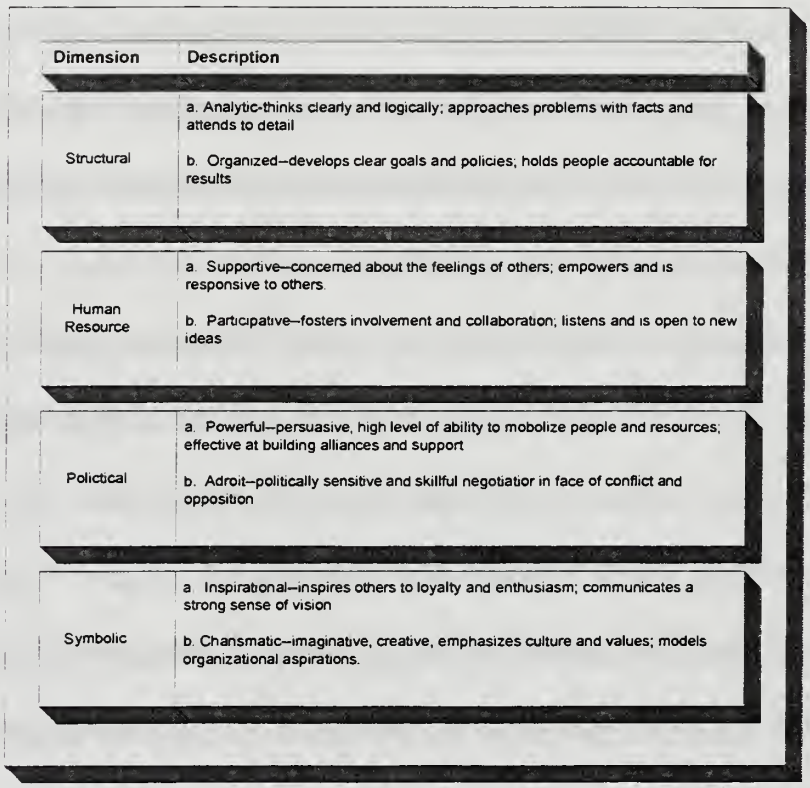
c) Dissertation Questions

- How many leadership frames do chief information officers use?
- Which frames do chief information officers use?
- Is there a relationship between educational and employment background and the number and choice of leadership frames?
- How do age, gender, and length of experience within higher education relate to CIOs' leadership orientations?
- Are the demographic and biographic characteristics of CIOs identified by Penrod et al. (1990) and Pitkin (1994) continuing today?
- Are the institutional roles and responsibilities of today's chief information officers consistent with those described by Penrod et al. (1990) and Pitkin (1994)?

d) The Bolman and Deal Model

The Bolman and Deal model is particularly useful for studying the leadership of the chief information officer because it acknowledges the diversity of issues and challenges associated with the implementation of technology. Becker's review of literature created a compelling picture of the difficulties confronting chief information officers as they lead technological change.

Bolman and Deal (1984, 1991a, 1997) view leadership from a cognitive perspective and argue that organizational activities and events can be viewed from multiple perspectives. Acknowledging that every leader brings a particular worldview to their role, Bolman and Deal collapse the inevitable multiplicity of possible perspectives into four frames: structural, human resource, political, and symbolic (See Figure 3.5). They argue that the ability to invoke a multiframe perspective is critical for effective leadership. Each of the four frames is described in the following sections (Becker, 1999).



Dimension	Description
Structural	a. Analytic-thinks clearly and logically; approaches problems with facts and attends to detail b. Organized–develops clear goals and policies; holds people accountable for results
Human Resource	a. Supportive–concerned about the feelings of others; empowers and is responsive to others. b. Participative–fosters involvement and collaboration; listens and is open to new ideas
Political	a. Powerful–persuasive, high level of ability to mobolize people and resources; effective at building alliances and support b. Adroit–politically sensitive and skillful negotiatior in face of conflict and opposition
Symbolic	a. Inspirational–inspires others to loyalty and enthusiasm; communicates a strong sense of vision b. Chansmatic–imaginative, creative, emphasizes culture and values; models organizational aspirations.

Figure 3.5 Becker's (1999) Multiframe Leadership Frames

(1) Structural Frame. The structural frame draws on the discipline of sociology and emanates from two intellectual traditions. One is

industrial science and includes the work of Taylor (1911) and Fayol (1919,1949). While each of these theorists focused on the organization's structure, they sought to understand the relationship of structure to efficiency and effectiveness in different ways. Taylor used time motion studies to break tasks down and then reconstruct them in a more efficient manner. Fayol assumed a wider view of the organization and attempted to develop a set of principles on specialization, span of control, authority, and delegation of responsibility. The second tradition underpinning the structural frame is the work of Max Weber. Weber sought to develop a model of organizations based on rationality. He described, but did not necessarily advocate, the bureaucratic model of organizations.

The structural approach is most effective in stable environments and when uniformity is required. Bolman and Deal link effective structural change to clear conceptualizations of organizational goals and strategies; solid understanding of the functioning of existing structures; and an awareness of the need for modifications to be congruent with changes in the organization's goals, technology or environment (Bolman & Deal, 1991a).

(2) Human Resource Frame. The human resource frame is grounded in organizational social psychology and focuses on the individuals who make up the organization. Organizational success and effectiveness are linked to people-conscious strategies that seek to meet the needs of the individual as well as the organization. The human resource frame considers

group relations and interpersonal dynamics as critical issues. Creating harmony between the needs of the individual and the needs of the organization are viewed as central responsibilities. Informal roles and norms are linked to leadership effectiveness with the concept of teamwork most fully realized within this frame. Effective human resource leaders rely on participation, collaboration, and empowerment of the individual to advance organizational goals and strategies. The human resource frame is most appropriate in situations where there is moderate uncertainty and conflict but the need for commitment and motivation remains high (Bolman & Deal, 1991a).

(3) Political Frame. The political frame was created and developed by political scientists. Within this perspective, organizations are viewed as arenas in which various interest groups vie for power and control of resources. Political leaders view organizations as coalitions comprised of individuals and interest groups with enduring differences in their values and beliefs. Organizational goals are realized through agenda setting, as well as by bargaining and negotiating with different groups. The emphasis in this frame is on authority, the interaction between conflicting groups, and power. The focus is not necessarily on the elimination or resolution of conflict, but rather on bridging various stakeholders' differing perspectives in order to realize goals. The political frame is useful when resources are scarce and uncertainty and conflict are high (Bolman & Deal, 1991a).

(4) Symbolic Frame. The symbolic frame draws on social and cultural anthropology and assumes that the meaning underlying events is more important than the event itself. This frame is especially important in organizations where goals are unclear and technologies uncertain Organizations are viewed as cultures with myths, rituals, and symbols assuming a vital role in activities. Effective cultural leaders recognize that how things are framed is crucial. Consequently, both events and their underlying processes perhaps are more important for what they express than for what they produce. Leadership involves interpretation of experiences and the discovery of common understandings. Goals are realized through the communication of organizational visions, as well as through the use of symbols and stories. The symbolic frame is helpful in situations marked by ambiguity and uncertainty (Bolman & Deal, 1991a).

(5) Multiframe Leadership. Bolman and Deal (1984, 1991a, 1997) argue that effective leaders need to invoke a multiframe perspective on organizational life. Becker (1999) states,

> "While this emphasis on a cognitively complex viewpoint is certainly well developed in their model, the importance of multiple perspectives is also evident in the work of other leadership scholars, including Kanter (1983), Perrow (1986) and Birnbaum (1988b). Each also espouses a multi-frame view of organizations. Kanter (1983) identifies segmentation, empowerment, power skills, and culture as key. Perrow (1986) cites bureaucracy, human relations, institutional school, and power. Birnbaum (1988b), who draws from a higher education background, describes the

> collegial, bureaucratic, political, and anarchic models and argues for a cybernetic view of organizations."

Becker (1999) cites several evolving bodies of work that support multiframe leadership. Some reports are studies based on loosely defined syntheses of the major leadership theories previously discussed. For example, she mentions

> "Lees, Smith and Stockhouse (1994) who analyzed their interviews of 10 higher education administrators for evidence of the following theoretical frameworks: power and influence, behavioral, trait, contingency, and symbolic. Others are published articles that use the Bolman and Deal model to guide discussions of organizational events and issues" (Becker, 2000).

Finally, Becker (1999) discusses a growing body of research that relies exclusively on the Bolman and Deal model. Many of these studies are dissertations, including Cantu's (1997) on academic deans, and Miller's (1998) study of occupational therapy chairpersons. The composite results of these studies provided Becker a substantial empirical support for her use of the multiframe leadership approach.

Becker's research shows that leadership has evolved from a primary focus on the traits and skills of the leader to a complex view that recognizes the importance of the situation, the followers, and their interaction. It is also important to point out that leadership research has been influenced by other disciplines as well, like anthropology, the behavioral sciences, and political

science. The understanding of today's leadership is linked with cognitive science theories, or the way in which individuals perceive and interpret information. This linkage provides powerful insight into the complexity of the leadership process and underpins the Bolman and Deal (1984, 1991a, 1997) model of leadership.

The discussion of findings for this study will be presented for analysis with the other studies in Chapter IV.

4. Shaping CIO Agendas in an 'E' World

a) Overview

This study by GartnerGroup Inc. was conducted through their executive programs, which now includes over 1,400 chief information officers (CIOs) from around the world. GartnerGroup analysts normally work with their members in a one-on-one basis and at their events and by survey to identify the priorities for the coming years. The GartnerGroup analyst synthesized the priorities that reflect on the evolving roles of CIOs. "The CIO is not dead or obsolete, but mutating into a number of species with different characteristics." (GartnerGroup, 2000)

GartnerGroup states "the priorities of leading CIOs toward 2001 can be summarized with four "e" words:

- Energizing enterprise strategy and initiatives
- Enabling new business and initiatives
- Executing cost-effective solutions

• Exploiting technologies, sourcing opportunities and benefits (GartnerGroup, 2000)."

Integral to these priorities are the interleaving of the enterprise, the external environment, and of course, the pervasive influence of e-business. The environment of which they are a part is shaping the nature of CIO priorities more than ever: the industry, enterprise business drivers, the investment climate, positioning for e-business and the perceived benefits of information technology (IT) investment in the enterprise (GartnerGroup, 2000).

GartnerGroup states that, "the genus CIO is mutating into a number of related species with different characteristics." There is an increasing differentiation between organizations. As with other executives, what is required and expected of a CIO is changing and evolving along with the shifts and changes in the enterprise and its environment (GartnerGroup, 2000).

The industry is not talking much about alignment of business they assume that the CIO is familiar with the role of alignment. The new focus of CIOs is "fusing" the business and IT to provide and take advantage of IT-enabled business capability.

b) From Alignment to Fusing Business and IT

The dissemination of technologies such as the Internet and the materialization of e-business are key principal to the rapid realization of the need to amalgamate business and IT decision making.

- "The notion of alignment has been transformed into a concern for dynamic fusion between business objectives and IT capabilities
- the fusion of business and IT is about enabling greater enterprise speed, innovation, adeptness and customer-centricity
- Implementing fusion requires that all executives learn a new and sometimes challenging set of languages, perspectives, decision rules and cultural values
- CIOs are working with their executive colleagues to derive greater value from IT investments and realize benefits while concurrently managing IT investments cost-effectively
- the business focus of the CIO and information systems (IS) organization is now assumed: The purpose of IT investments is to ensure that business initiatives are both enabled and stimulated
- the business focus is usually in addition to CIO's technology leadership responsibilities. The nature and level of responsibilities continues to expand
- in this environment, the priorities of CIOs are set in the context of wider external drivers and enterprise initiatives" (GartnerGroup, 2000).

The definition of fusion in the world of physics as discussed by GartnerGroup, "refers to a thermonuclear reaction in which nuclei of light atoms join to form nuclei of heavier atoms. This results in the release of large amounts of energy" (GartnerGroup, 2000)

GartnerGroup confers that as the picture of e-business becomes clearer and more pervasive throughout the world, the "fusion" of business and IT is necessary to harness the energy and creativity to develop and sustain new personal competencies and organizational capabilities. As e-business becomes the way we do business, fusion has occurred (GartnerGroup, 2000).

c) CIO Context

External drivers and enterprise initiatives set the context for CIO priorities and emerging CIO concerns. These environmental factors are represented graphically with a set of concentric circles with external drivers as the outer circle putting pressure on enterprise initiatives (Figure 3.6). These initiatives shape the agendas for CIOs and their leadership, management and technology priorities. Specific priorities for individual CIOs are identified and achieved through the leadership they demonstrate in two key ways:

- Strategizing with business executives as part of sound, but flexible, governance processes
- Creating and sustaining core capabilities for the next-generation IS organization.

- Exploring each component - external drivers, enterprise initiatives, CIO leadership, and management and technology priorities - and consider how they are shaping the mutation of the CIO species.

d) External Drivers: Pushing Performance

GartnerGroup suggests that there are eight interdependent external drivers that are changing the nature of competitive forces and public sector mandates that are pushing the performance of enterprises. The current environment is a result of greatly heightened customer expectations, but in the context of a demand and requirement for lower cost structures. The inference made by GartnerGroup is that many governments (United States, Europe and Asia) are changing the ground rules of competition. Governments, in turn, are making revolutionary changes in their relationships with the public by reevaluating expectations, privatizing of assets, different approaches to purchaser-provider arrangements, and, in many countries, privatization of what were public assets, especially in the utilities and telecommunications areas (GartnerGroup, 2000). GartnerGroup (2000) further explains that the impact of these eight external drivers differs in regions and industries.

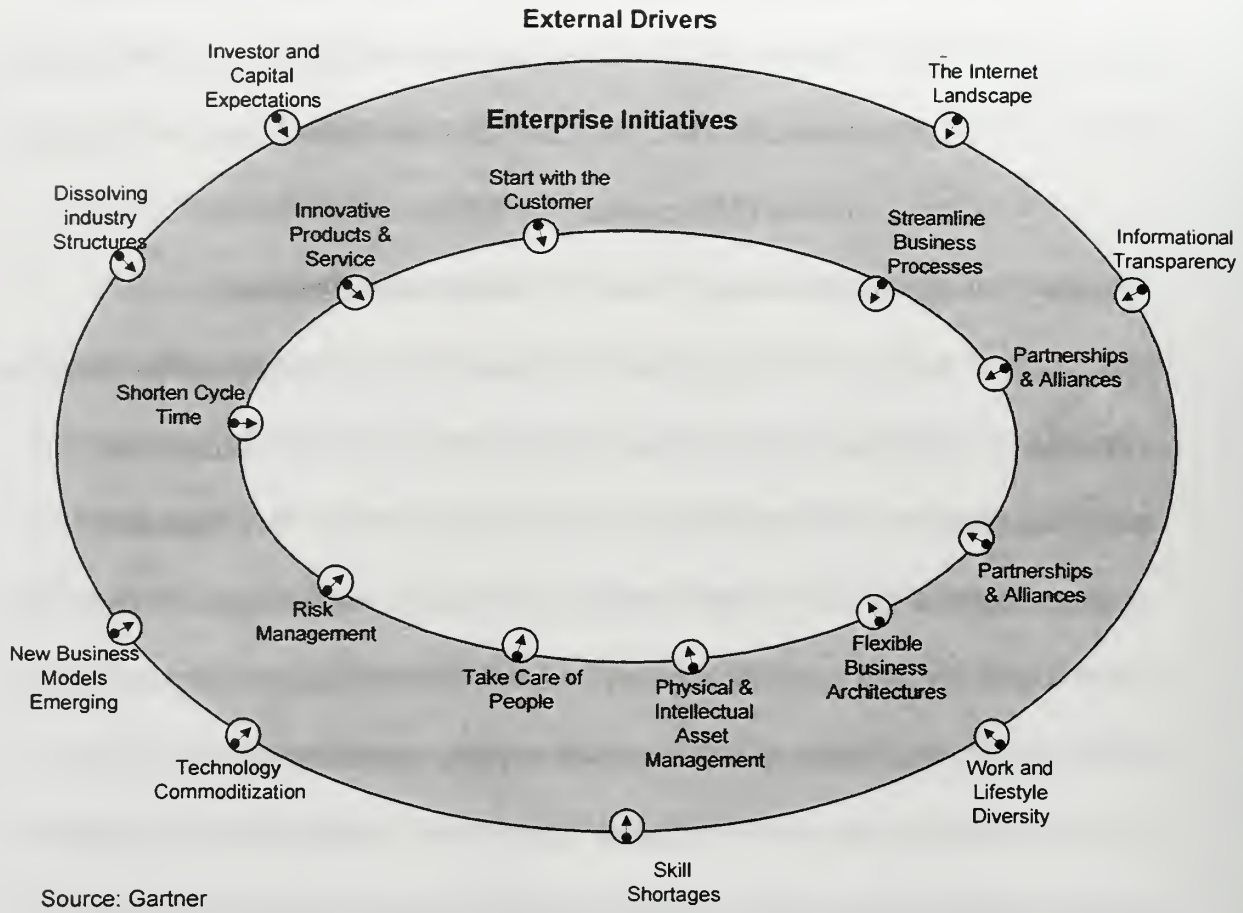


Figure 3.6 GartnerGroup's (2000) External Drivers and Enterprise Initiatives

e) Enterprise Initiatives: Leading and Responding

GartnerGroup uses ten enterprise initiatives depicted in the model above to encompass the major experiences of GartnerGroup's Executive Program clients. While the emphasis of each is different, "there are common themes that indicate how enterprises are responding to the volatility and uncertainty in their environments" (GartnerGroup, 2000).

f) Enterprise Initiatives and the CIO

The CIO must evaluate the positioning of the various parts of their enterprise in relation to each of the enterprise initiatives. The evaluation would be to measure the extent that the organization is "leading or lagging with customer-centric processes? How critical is our focus on cycle time? How much effort are we putting into creating innovative products and services? How are these initiatives impacting on our business model - the nature of relationships and value propositions we have with customers, suppliers and other stakeholders? The answers to these questions will shape the particular species of CIO appropriate for the enterprise at any given point in time"(GartnerGroup, 2000).

g) Energizing, Enabling, Executing and Exploiting

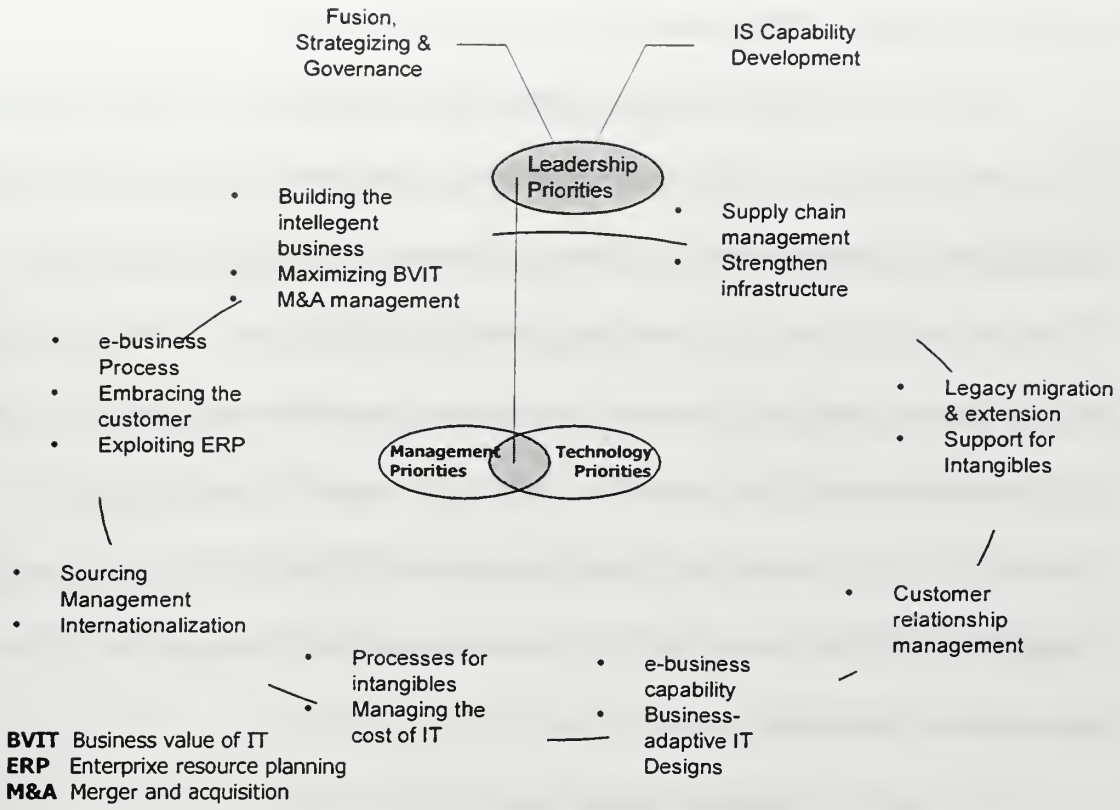
The priorities of each CIO are set in the context of his or her enterprise and its environment. Increasingly, the CIO is a key energizer of strategy and new ways of doing business, anticipating customer demand and linking suppliers. In other enterprises, the CIO is an enabler, ensuring that the resources are in place, or can be quickly marshaled, for the business to achieve its ambitions.

Concurrently, many CIOs have responsibility for ensuring that they can execute specific strategies or that they are able to maintain vital services. When technology-enabled services are in place, the CIO often needs to prod and

support business groups to ensure that the capabilities in place are used well and that benefits are realized (GartnerGroup, 2000).

The four "e" words provide the underlying theme for CIO leadership, management and technology priorities, depicted in Figure 3.7. GartnerGroup focused questions around each of the CIO priorities that were identified in Figure 3.7. They use this information to shape their meetings with clients and annual GartnerGroup events.

The remainder of the GartnerGroup Research findings is presented in Chapter IV for analysis with the other case studies findings and documents information.



Source: Gartner

Figure 3.7 GartnerGroup's (2000) CIO Priorities

5. Developing Core Competencies and Measures of Effectiveness for a Navy Medical Chief Information Officer

a) Overview

The author of Developing Core Competencies and Measures of Effectiveness for a Navy Medical Chief Information Officer, LCDR Thomas E. Moszkowicz, USN, MSC, concludes that not all organizations benefit from the establishment of a CIO. Moszkowicz (1997) continues on this note stating that

those organizations that rely on information resources to accomplish their mission will gain a strategic advantage form the position of the CIO.

b) Purpose

The purpose of Mosckowicz's thesis was to use a critical success factors methodology to identify the core competencies and skills for civilian and Department of Defense Chief Information Officers. Through the evaluation of these two group's core competencies and skill sets, Moszkowicz (1997) proposed to develop a composite of the core competencies and skills necessary for a DoN medical department CIO. In addition, the thesis sought to develop a set of measures of effectiveness (MOEs) for the medical CIO in a DoN environment to gauge their effectiveness in contributing to the executive management of the organization. (Moszkowicz, 1997)

c) Research Questions

The primary research questions Moszkowicz's thesis examined:

- What are the responsibilities of a medical CIO in a civilian environment?
- What are the core competencies of a medical CIO in a civilian environment?
- What are the responsibilities of a CIO in the Department of the Navy (DoN) environment?

- What are the core competencies of a medical CIO in a DoN environment?
- What similarities and differences exist between a medical CIO in a civilian environment and a CIO in a DoN environment?
- What are the core competencies required of a medical CIO in a DoN environment?
- Based on the core competencies required, what are the skills that a medical CIO in a DoN environment should have to be and effective management executive?
- What are measures of effectiveness (MOEs) the medical CIO in a DoN environment can use to determine how well they are contributing to the executive management of the organization? (Moszkowicz, 1997)

d) Methodology

Moszkowicz (1997) used a "Critical Success Factors (CSF)" concept developed by John Rockart at the Sloan School of Management, Massachusetts Institute of Technology in the late 1970s. This model was initially designed to help executives determine their information needs. Although, the extensive use of the CSFs it was found to be useful at both the executive and management levels of the organization and the management process in general. CSFs define

areas in an organization that if done correctly could result in a positive outcome. There are four identified areas where CSFs had an influence:

- the structure of the particular industry;
- the company itself;
- the environment;
- temporal or time-dependent factors. (Rockart, 1979)

(1) The Structure of the Industry. Industries have their own CSFs, which are defined by the characteristics of the industry. The author gives an example of the automotive industry having a quality dealer system. The quality dealer system CSF would not work in the healthcare or grocery industry but could possibly work with supply vendor agreements. In the healthcare industry it is important for have the drug formularies to contain certain medications. Again this CSF may not translate back into the automotive industry. It is important for executives to understand the industry/business they operate in to identify appropriate CSFs (Rockart, 1979).

(2) The Company or Organization. The branches of the military each have their own culture; each company in an industry has a unique situation. Many factors, history, industry position, market, geography, management team, environment and competitive strategy determine the culture of an organization. Other factors that need to be considered are the internal politics and centers of power (Rockart, 1979).

(3) The Environment. As the economy reacts to the pressures of political parties and the rise and fall of the stock market, CSFs can change. The CSFs need to be adjusted to meet the needs in a changing environment. These changes are independent from the industry or the company. An example is the energy "crisis" during the mid-1970s. Prior to 1973, virtually no executive in the United States would have considered the availability of fuel as a critical success factor. With the induction of the oil embargo by certain oil producing nations, the cost of fossil fuels skyrocketed (Rockart, 1979).

(4) Temporal Factors. Some internal organizational considerations lead to temporal CSFs. They are factors that become critical because they are below the threshold of acceptability at a particular moment in time. Consider a critical position that goes unfilled for a period of time or the executive team is lost because of some disaster; for example, a CSF could be to obtain someone for the position and to hire a competent executive staff to replace the ones that were lost. Surveys represent a good source to temporal CSFs along with the industry trade journals. This CSF addresses the executive's ability to manage in a changing environment (Rockart, 1979).

e) Survey Methodology

With the use of a survey tool Moszkowicz (1997) obtained Navy medical CIO's opinions on what they believed to be the core competencies were

of a Navy CIO. The survey contained demographic questions to determine if the respondents were the CIO. The survey also contained a list of fifty-three potential core competencies from numerous sources. The respondents were given the choice of yes or no next to each potential competency. Although this method is not recommended in scientific studies because it doe not provide the respondents a degree or range for positive or negative responses. This could lead a survey participant to answer to an extreme when they actually are somewhere in between. The author also conducted interviews and discussions with the participants in regard to the current and potential measures of effectiveness for Navy Medical CIOs (Moszkowicz, 1997).

f) Thesis Methodology

Moszkowicz (1997) used the literature review section of his thesis to determine the various factors about each type of CIO's industry, organization, environment, and temporal. He then developed a list of CSFs for both military and civilian medical CIO and a DoD CIO. The author reviewed each CSF and selected applicable core competencies from a list of potential core competencies developed for the Navy medical CIO survey. A core competency, as defined by Moszkowicz (1997), "is a proficiency that CIOs must have if they are to be successful at a CSF." The list was compared with the CSFs to determine if there are any other factors needed to meet each critical success factor successfully.

The data were then computed to determine the core competencies for a civilian medical CIO and a DoD CIO.

In combining of the two groups, civilian medical CIO and a DoD CIO, the thesis describes the core competencies and skills necessary for a Navy medical department CIO. The survey tool was used to validate the author's assertions of what the skills and core competencies of a Navy medical CIO should be.

Finally Moszkowicz (1997) reviewed the core competencies of Navy medical CIOs. He then interviewed prior, current and potential Navy medical CIOs to develop a set of proposed measures of effectiveness.

The findings of the LCDR Moszkowicz' research are presented in Chapter IV for analysis with the other case studies and information.

6. Developing a Core Competency Model for Information Systems Management Officers In the United States Army, "The Army's Version of the CIO"

a) Purpose

The purpose of this thesis written by Captain P Dwight Hunt, USA and Major Stephen T. Willhelm, USA, Master's in Information Technology/ Management was to determine what competencies, knowledge, skills and attributes that a FA 53 officer[29] needs to possess to excel at his/her job. The FA 53 officer is the Army's equivalent to the CIO, the individual responsible for the

[29] FA 53 Officer: The Army's System Automation Management officer (Hunt & Willhelm, 2000).

automation and information management in the Army. The list of competencies the System Administrator describes in DA Pamphlet 600-3, Commissioned Officer Development and Career Management is the only document that comes close to describing the competencies, knowledge, skills and attributes needed by the FA 53 officer. It provides a general job description but not core competencies.

The authors proposed a solution to this problem in the form of a system automation management officer competency model. The competency model process takes a comprehensive view of the position, the people needed to fill it, and the competencies that a FA 53 officer must obtain in order to excel at his/her duties. The competencies will be decomposed into the knowledge, skills and attributes that the officer can focus on in order to prepare him/her for the role. In addition, the competency data will allow personnel and training managers to ensure that they are creating programs that will succeed.

b) Objective

The primary objective of this research is to create a competency model for the U.S. Army's Information Technology Management officers. Its secondary objective considers the use of the competency model. More specifically, what do you use the competency model for once it is created?

c) Research Questions

The following research questions address these primary and secondary objectives.

- What exactly are the core competencies of the Army's System Automation Officer (Functional Area 53)?
- Using the core competency model, what are the courses that should be taught in the Selection Acquisition Corps (SAC) course and in graduate school which cover all core competencies of the System Automation Management Officer?
- How can the Army's FA 53 education system be improved to increase the overall level of education these officers receive?

d) Methodology

For this study Hunt and Willhelm (2000) chose the Customized Generic Model Method to develop a competency model for the FA 53 officer. "The method was chosen due to the extensive competency studies conducted by the federal government and the large number of proprietary companies that specialize in competency modeling for information technology managers." Following the steps of the customized generic model method the authors derived a competency model for FA 53 officers.

(1) Competency Development Process. The steps for using the customized generic model method include the following:

- Enlist client or group support and develop a project plan.

- Assemble and review all available information pertinent to the job.
- Research an initial set of job competencies and identify performance criteria for success in the job.
- Organize a focus group.
- Convene the focus group and develop a draft competency model.
- Finalize and validate the competency model.
- Provide the final project results and products.

(2) Competency-Based Training and Development.

Competency-based training and development activities include formal training programs; development center feedback; self-development resources guides; computer and interactive video-assisted self instruction; job assignments; mentoring relationships; organizational structure, process and culture intervention designed to increase an individuals competence. There are seven steps in developing a competency-based training program:

- Develop a competency model.
- Identify which competencies are the most cost-effective to train versus which competencies to select for.
- Select the most cost-effective development options.

- Develop assessment methods and training curricula.
- Train trainers.
- Train leaders.
- Evaluate training results. (Hunt & Willhelm, 2000)

A validated competency model provided the core competencies needed for superior performance in a job. Core competencies and traits can be trained. Hunt and Willhelm (2000) suggest that it might be more cost-effective to hire a person that possesses these competencies instead of training someone who doesn't possess them. Hunt and Wilhelm (2000) put forth that personnel evaluations address the competency areas that an individual needs to focus their individual training efforts. Finally they imply that formal evaluation process will ensure the competency model and follow on training programs to support the organization's strategic vision.

7. United States Department of Labor: Bureau of Labor Statistics

a) Overview

The Bureau of Labor Statistics (BLS) is the principal fact-finding agency for the Federal Government in the broad field of labor economics and statistics. The BLS is an independent, national statistical agency that collects, processes, analyzes, and disseminates essential statistical data to the American public, the U.S. Congress, other Federal agencies, State and local governments,

business and labor. The BLS also serves as a statistical resource to the Department of Labor.

BLS data must satisfy a number of criteria, including relevance to current social and economic issues, timeliness in reflecting today's rapidly changing economic conditions, accuracy and consistently high statistical quality, and impartiality in both subject matter and presentation. With this mission of the BLS in mind I will present the framework for the case comparisons.

b) Work Activities

The nature of the work of the computer and information systems manager requires them to plan, coordinate, and direct research, design, production, and computer-related activities. They may supervise engineers, scientists, technicians, computer specialists, and information technology workers, along with support personnel (BLS).

This manager use advanced technical knowledge of engineering, science, and computer and information systems to oversee a variety of activities. They determine scientific and technical goals within broad outlines provided by top management. These goals may include the redesigning of an aircraft, improvements in manufacturing processes, the development of large computer networks, or advances in scientific research. Managers make detailed plans for the accomplishment of this goals-for example, working with their staff they may

develop the overall concepts of a new product or identify technical problems standing in the way of project completion (BLS).

To perform effectively, they must also possess knowledge of administrative procedures, such as budgeting, hiring, and supervision. These managers propose budgets for projects and programs, and make decisions on staff training and equipment purchases. They hire and assign scientists, engineers, computer specialists, information technology workers, and support personnel to carry out specific parts of the projects. They supervise the work of these employees, review their output, and establish administrative procedures and policies (BLS).

In addition, these managers use communication skills extensively. They spend a great deal of time coordinating the activities of their unit with other units or organizations. They confer with higher levels of management, with financial, production, marketing, and other managers, and with contractors and equipment and materials suppliers (BLS).

Computer and information systems managers direct the work of systems analysts, computer programmers, and other computer-related workers. These managers plan and coordinate activities such as the installation and upgrading of hardware and software; programming and systems design; the development of computer networks; and the implementation of Internet and intranet sites. They analyze the computer and information needs of their

organization and determine personnel and equipment requirements. They assign and review the work of their subordinates, and purchase necessary equipment (BLS).

c) Working Conditions

Training, Other Qualifications, and Advancement

Strong technical knowledge is essential for computer and information systems managers, who must understand and guide the work of their subordinates and explain the work in non-technical terms to senior management and potential customers. Therefore, these management positions usually require work experience and formal education similar to that of engineers, mathematicians, scientists, or computer professionals (BLS).

Many computer and information systems managers have experience as systems analysts; others may have experience as computer engineers, programmers, or operators, or in other computer occupations. A bachelor's degree is usually required for management positions and employers often prefer a graduate degree. However, a few computer and information systems managers may have only an associate's degree. Employers seek managers who have experience with the specific software or technology to be used on the job. In addition to technical skills, employers also seek managers who have business and interpersonal skills (BLS).

Engineering, natural science, and computer and information systems managers may advance to progressively higher leadership positions within their discipline. Some may become managers in non-technical areas such as marketing, human resources, or sales. In high technology firms, managers in non-technical areas often must possess the same specialized knowledge as managers in technical areas. For example, employers in an engineering firm may prefer to hire experienced engineers as sales people because the complex services offered by the firm can only be marketed by someone with specialized engineering knowledge (BLS).

d) Related Occupations

The work of engineering, natural science, and computer and information systems managers is closely related to that of engineers, life scientists, physical scientists, computer professionals, and mathematicians. It is also related to the work of other managers, especially general managers and top executives (BLS).

B. SUMMARY

The research for this thesis is based on the studies presented in this chapter. Each study focused in a few areas of the CIO. Smaltz (1999) talked about the relationships between the TMT and the CIO and the effects upon their effectiveness along with the Capabilities in the government and private sector health care arena. Moszkowicz (1997) looked the critical success factors for

civilian medical Chief Information Officer and the Department of the Navy CIO to derive their core competencies and to ultimately create a set of core competencies for a Navy medical CIO. Hunt and Willhelm's (2000) approach was to use a core competency development model to create the core competency and training model for the Army's Functional Area 53 officer. The research by Becker (1999) investigated the level of cognitive complexity of the CIO using the Bolman and Deal multiframe leadership tools. She also used this methodology to develop a current profile of the CIO in higher education. A study completed by the GAO (2000) focused on the ways to implement an effective CIO organization. This GAO study also used critical success factors, as did Moszkowicz (1997), to define the organization requirements. The GAO's methodology interviews and site visits to various leading organization to derive their conclusions. The final study, by GartnerGroup Inc. discussed the CIO and identified several external drivers, internal initiatives and CIO focus areas that affect the CIOs roles in the future. The study also used a chart from the Sloan School of Business, which can be used to gage the position, roles and leadership in regards to information management and technology in an organization. And closing the chapter was a description of the U.S. Department of Labor: Bureau of Labor Statistics position of the Computer and Information Systems manager.

The six studies and documents presented provide the background for the analysis of their findings. Chapter IV provides the findings from these studies. In

Chapter V the a compilation of the findings will provide a composite CI^2O profile to include, critical success factors, hierarchical position in the organization, roles, education, and experience from the studies and a brief discussion on how they answer the thesis questions and relate to the mature learning organization.

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IV. RESEARCH STUDIES FINDINGS

This chapter presents a summary of findings from the studies and documents from Chapter III. The six studies in Chapter III focus on many areas in developing a CI^2O organization such as defining key success factors, hierarchical levels, roles, core competencies, education, and experience. The findings are used in the final analysis and compilation of what the CI^2O needs to know and their role of the in the Navy. The questions presented in Chapter II will be addressed in Chapter V.

A. GOVERNMENT ACCOUNTING OFFICE (GAO) REPORT: IMPLEMENTING EFFECTIVE CIO ORGANIZATIONS

The findings of the GAO study imply that an organization can implement a successful CIO organization by focusing on three Critical Success Factors (CSF). The CSFs define are 1) align IM leadership for value creation, 2) promote organization credibility, and 3) execute IM responsibilities. Each CSF has two key principles identified, which further define the requirements for success. A further breakdown of each principle into key characteristics defines the functional or operational level of detail.

Critical Success factor A: Align IM Leadership for Value Creation

Principle I. Demonstrate the ability to understand and recognize information management's role in creating value. In other words, take steps in

building business plans that incorporate information management and appreciate the overall influence that IM has on strategic direction.

Principle II. Moving to clearly define the role of the CIO by plainly spelling out the overall duties and responsibilities of the CIO and how, exactly, he or she fits into the senior management team.

Critical Success factor B: Promote Organizational Credibility

Principle III. Finding a way to guarantee CIO credibility. All directives from the CIO should be viewed as essential to the organization. CIOs must look outside of their inner circles for partnerships and peer exchanges.

Principle IV. CIOs must balance business and technical needs while demonstrating results - and successes. They must build a mechanism for regular feedback.

Critical Success factor C: Execute IM Responsibilities

Principle V. Information management must be able to adapt quickly to the ever-changing environment. Structures must be flexible yet still designed to meet necessary business needs.

Principle VI. Building information management talent. Finding ways to identify, attract, train and keep IT talent.

In addition, several key characteristics further define each of CSF principles. These key characteristics can provide insights into what constitutes successful CIO organizations (GAO/T-AIMD-00-128).

As mentioned above, the study was able to identify three critical success factors and six principles that fit under them. As the CIO develops strategies for each of the six principles his/her needs to consider who else in the organization must be involved in the leadership and what parts of the organization must be involved in the implementation (See Figure 4.1).

The six principles fall naturally into three distinct sets based on overarching intent of the principle. For example, the principle addressing the need to organize IM to meet business needs and the principle that addresses the need to develop IM human capital both focus on the CIO's effectiveness in carrying out the IM organization's specific responsibilities. The higher order "principle" can be thought of as a critical success factor, and the underlying principles are the activities that must take place in order to achieve the critical success factor.

The principles advocating the need to recognize the role of IM in creating value and positioning the CIO for success both address issues of senior executive support. Both principles require that the leaders of the enterprise embrace the critical role IM can play in the success of the organization and the leadership role the CIO must play in order for IM to meet its potential. The first principle addresses the acceptance of this premise by senior executive management, and the second assures that the CIO has the organizational legitimacy to execute their role.

"The principle that addresses the need to ensure the credibility of the IM

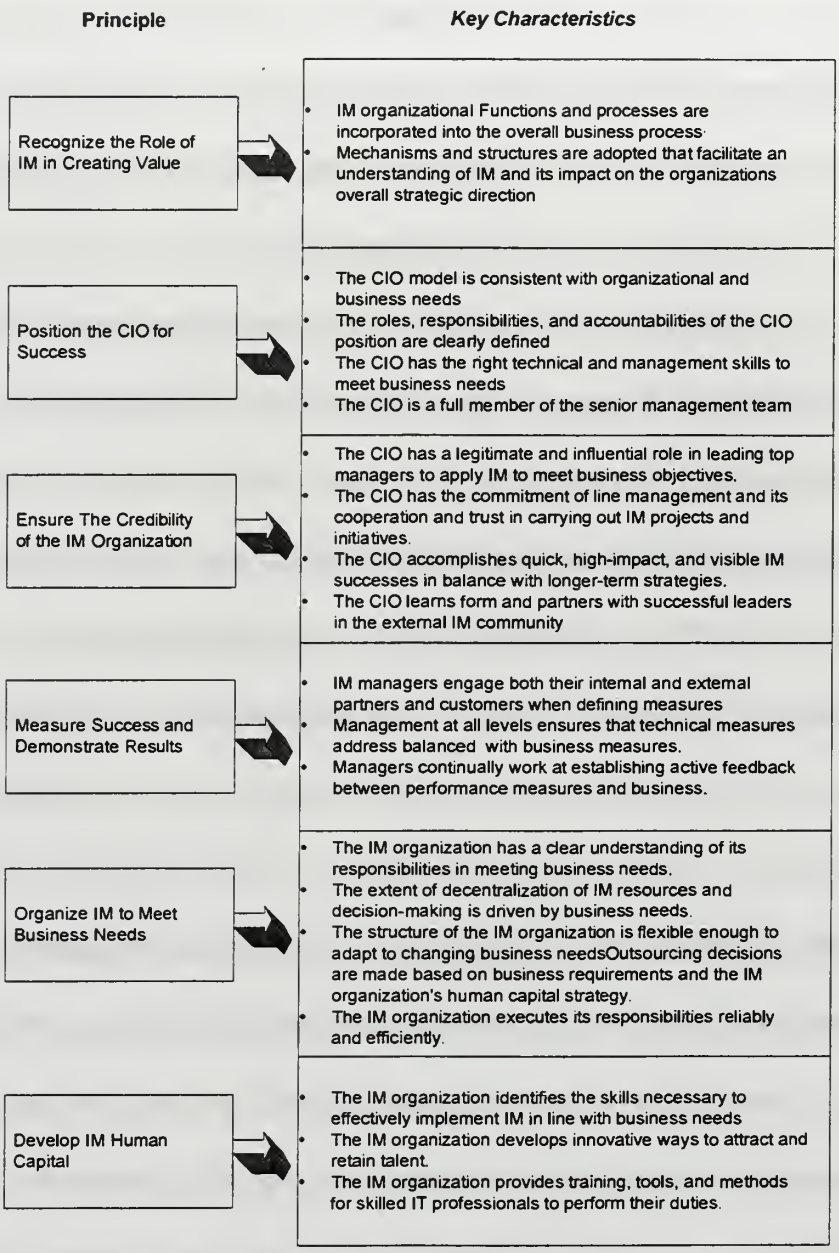

Figure 4.1 GAO (2000) Study Principles and Key Characteristics

organization and the principles that encourages measuring success and demonstrating results, if executed successfully, will lead to the confidence of those with operational responsibility in the enterprise. Without credibility, the IM

organization will struggle to be accepted as a full participant in the development of new organizational systems and processes. Figure 4.2 illustrates the six principles and their relationship with the three critical success factors. While the first success factor refers to legitimacy and a strategic planning a level, this success factor addresses a more operational level" (GAO/T-AIMD-00-128)

As mentioned in the preceding paragraph, organizing IM to meet business

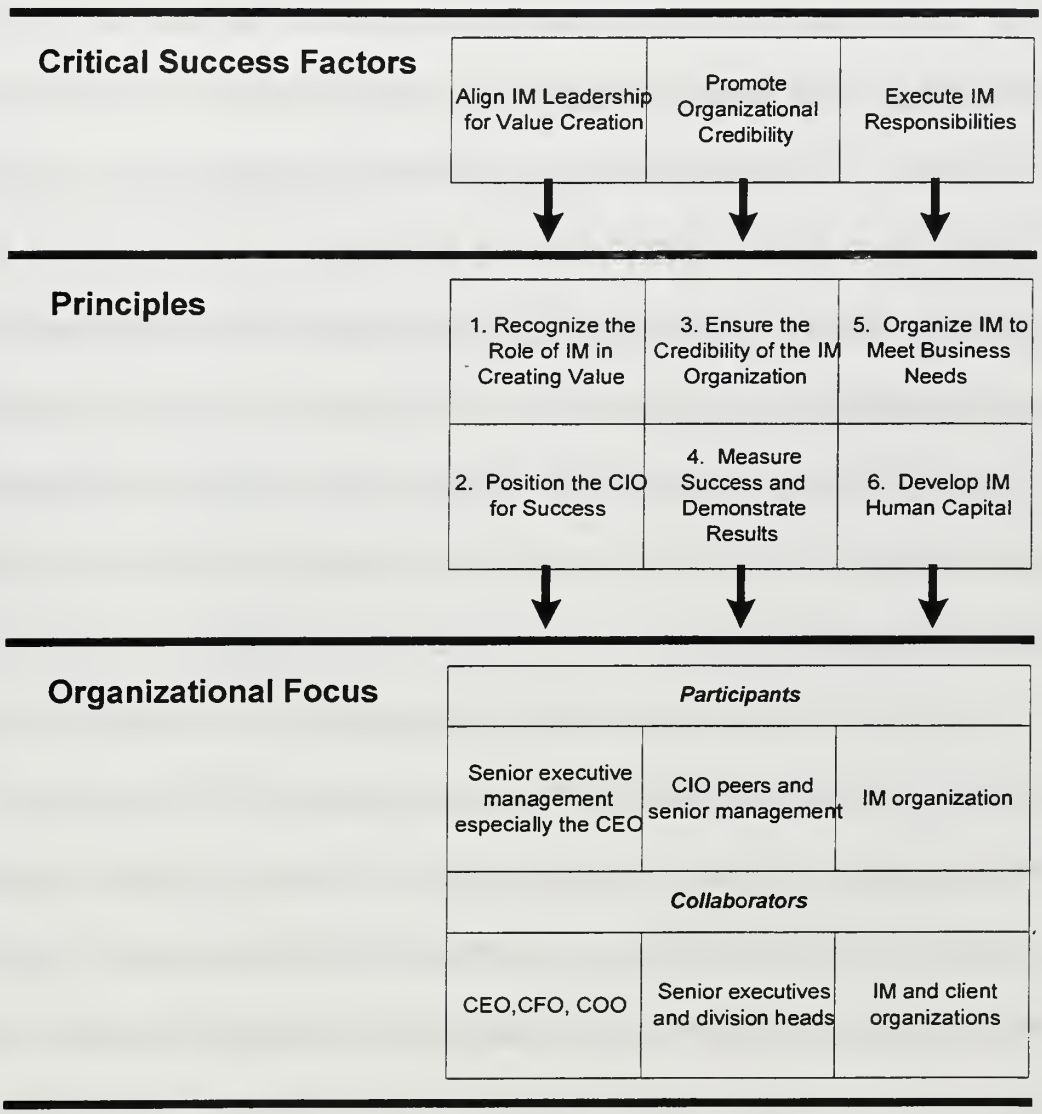

Figure 4.2 GAO (2000) Study Critical Success Factors

needs and developing IM human capital will provide the foundation for the CIO's effectiveness in carrying out the IM organization's specific responsibilities. This is the third leg of the success factors. Once executive management endorses the centrality of the IM organization, and IM becomes a partner in the development of new systems, the IM organization must execute its responsibilities successfully (GAO/AIMD-00-128).

Understanding the six principles in terms of critical success factors is particularly useful because of features that are shared by principles within the same factor. For example, both principles within a single critical success factor require the same organizational units to collaborate in their execution. Also, both principles within a critical success factor focus on the same organizational units as the targets of their implementation. In the case of the critical success factor, "Promote Organizational Credibility," both principles rely on the collaboration of senior executives and division heads for success and have as their target the senior management of the enterprise (GAO/AIMD-00-128).

In conclusion, the organization of principles into critical success factors illustrates that extent to which the work of a successful CIO must extend throughout the enterprise. In particular, the role that the CEO and other senior mangers play in ensuring the success of the CIO should be noted. While it is the responsibility of the CIO to execute the specific responsibilities of their position, it became clear during the study, especially in the case studies, that the successful

CIO relies extensively on vertical and horizontal relationships within the enterprise in order to carry out his/her responsibilities.

B. ANTECEDENTS OF CIO EFFECTIVENESS: A ROLE-BASED PERSPECTIVE

Smaltz's study examined the relationships between CIO capability, TMT/CIO engagements and CIO effectiveness. The cross-sectional field study employed a survey methodology. Questionnaires were both mailed and e-mailed to CIOs and TMT members resulting in 106 organizations in which both CIO and at least one of the organization's TMT members responded.

Analysis of the data found that all six of the Smaltz's role based CIO effectiveness dimensions yielded highly significant loading factors to the CIO effectiveness construct. These significant loading factors provided the study with a valid dependent variable that captured CIO effectiveness along six different role-based dimensions. Overall, the model explained 66% of the variance in CIO effectiveness. In addition, Smaltz (1999) found that a CIO's political savvy, a CIO's interpersonal communication skill, and the extent of the CIO's strategic business knowledge are all significant reflective indicators of a CIO's overall capability. Moreover, a significant relationship between CIO capability and CIO effectiveness was found. No support was found for the hypothesis that the strategic vision of IT moderates the relationship between CIO capability and CIO

effectiveness. Smaltz (1999) noted that this non-finding might have resulted from inadequate subsample groups and therefore remains inconclusive.

Analysis also revealed that a CIO's extent of trusting relationships formed with TMT members, their formal membership on the TMT, and their extent of formal interaction with the TMT members were significant indicators of TMT/CIO engagements. On the other hand, the hierarchical level of the CIO and the extent of informal interaction with the TMT members were not a significant indicator of TMT/CIO engagements. The results of the survey on the hierarchical, IT vision and type of organization are presented in the Table 4.1. Additionally, no significant relationship between TMT/CIO engagements and CIO effectiveness was found.

Construct	N	Missing
TMT's Strategic Vision of IT (N=106)		0
Automate	17(16%)	
Informate Up	24 (22.6%)	
Informate Down	35 (33%)	
Transform	30 (28.4%)	
Levels of Management Between CIO and CEO (Valid N=98)		8
0 (Direct Report)	17 (17.3%)	
1	77 (78.6%)	
2 or more	4 (4.1%)	
Dominant Organizational Strategy (Valid N=104)		2
Low Cost Provider	42 (40.4%)	
Differentiation	41 (20.2%)	
Niche	21 (20.2%)	
Tax Status of Organization (N=100)		6
For Profit	6 (6%)	
Not-for-Profit	49 (49%)	
Not-for-Profit (Government)	45 (45%)	
Type of Organization (N=100)		6
Teaching Hospital	33 (33%)	
Non-teaching Hospital	28 (28%)	
Corporate/Regional Headquarters	26 (26%)	
Clinic/Group Practice	10 (10%)	
Other	3 (3%)	

Table 4.1 Smaltz's (1999) Survey Data

A summary of Smaltz's (1999) Hypothesis and results is presented in Table 4.2.

Hypothesis	Results
Hypothesis 1: CIO capability is positively related to CIO effectiveness, as perceived by the members of the TMT.	Supported
Hypothesis 1a: The degree to which a CIO has a high degree of political savvy is positively related to CIO organizational effectiveness, as perceived by the members of the TMT.	Supported
Hypothesis 1b: The degree to which a CIO communicates in terms that the other members of the TMT can understand is positively related to CIO organizational effectiveness, as perceived by the members of the TMT.	Supported
Hypothesis 1c: The degree of business knowledge held by the CIO is positively related to CIO organizational effectiveness, as perceived by the members of the TMT.	Supported
Hypothesis 1d: The degree of IT knowledge held by the CIO is positively related to CIO organizational effectiveness, as perceived by the members of the TMT.	Supported
Hypothesis 2: TMT/CIO engagements are positively related to CIO effectiveness, as perceived by the members of the TMT.	Not Supported
Hypothesis 2a: The hierarchical level of the CIO is positively related to CIO organizational effectiveness, as perceived by the members of the TMT.	Not Supported
Hypothesis 2b: TMT membership is positively related to CIO organizational effectiveness, as perceived by the members of the TMT.	Not Supported
Hypothesis 2c: Extent of trusting relationships developed with the other members of the TMT is positively related to CIO organizational effectiveness, as perceived by the members of the TMT.	Not Supported
Hypothesis 2d: Extent of trusting relationships developed with the other members of the TMT is positively related to CIO organizational effectiveness, as perceived by the members of the TMT.	Not Supported
Hypothesis 3: CIO capability is positively related to TMT/CIO engagements.	Supported
Hypothesis 4: The impact of CIO capability on CIO organizational effectiveness will be stronger for organizations that articulate a 'transform' vision than for organizations that articulate an 'automate' vision.	Not Supported
Hypothesis 5: The impact of the level of TMT/CIO engagements on CIO articulate a 'transform' vision of IT than for organizations that articulate an 'automate' vision of IT.	Not Supported

Table 4.2 Smaltz's (1999) Hypothesis Results

C. IMPLEMENTING TECHNOLOGY IN HIGHER EDUCATION: THE LEADERSHIP ROLE AND PERSPECTIVES OF THE CHIEF INFORMATION OFFICER

In Becker's study she stated that there were two phases of her data gathering. Phase I of the study of the included a survey questionnaire comprised of two parts: Bolman and Deal's (1990) standardized instrument, Leadership Orientations (Self), and a section designed to obtain demographic and biographic, as well as institutional data on the role of chief information officers. This instrument was mailed to 215 chief information officers identified as through the CAUSE Institutional Database (Becker, 1999).

In phase II of Becker's study, 12 randomly selected chief information officers were interviewed by telephone. A two-part interview schedule was used to lead these conversations. Part I asked respondents to describe the functions and activities related with their position, as well as for an explanation of their leadership style. The second part asked respondents to relate a situation, or critical incident, where they believed they employed leadership. These incidents were coded for evidence of Bolman and Deal's (1984, 1991a, 1997) leadership frames. Becker's third Phase of her study asked survey respondents to furnish copies of their job descriptions and curricula vitae. The job descriptions were coded for institutional expectations of CIOs as well as for evidence of the four leadership frames (Becker, 1999).

Of the 131 respondents to the survey, 109 were male and 22 female. Reported ages range form 26 to 66 years with a mean of 50.6 years. The largest portion is between 50 and 54. The group's educational attainment is substantial with 55% of the CIOs reporting that they had earned a Master's degree. An additional 27.5% indicated that they had doctorates, while 14.5% reported holding Bachelor's degrees. The areas of specialization for these degrees spanned numerous fields, with the largest percentage (28.2%) citing business-related fields as their area of specialization. Computer and information science (21.4%) ranked second, while education (16%) was reported third (Becker, 1999).

The responses related to work history revealed that 30.5% of the CIOs have served in their current position for less than three years. However, 30.5% also report having been employed previously as a CIO, with 25.2% of those individuals reporting that their previous CIO position as a college or university. When these previous positions are considered, overall experience as a CIO expands to 6 to 10 years for 34.4% of the respondents. The higher education experience of the group is also substantial, with 45.8% of the CIOs reporting more than 20 years of employment in a college of university (Becker, 1999).

1. Multiframe Leadership

Multiframe leadership, 27.5%(36) of the respondents demonstrated consistent use of three or more frames, while 21.4% reported using two frames

consistently. The eight (66.7%) of the CIOs interviewed reported consistent use of three or more frames during their descriptions of a critical incident involving leadership. The remaining four interviewees reported two or more leadership frames (Becker, 1999).

2. Frame Choices and Use

Becker (1999) reported that the only frame used consistently by all study participants was the human resource frame. The frame least used by the CIOs was the symbolic. The critical incidents divulged during the phone interviews revealed the structural frame as the frame of choice and used by all twelve CIO interviewees. The use of political (75%) and human resource (58.3%) frames was noted. The quantitative and qualitative results were consistent in regards to the symbolic frame (33.3%); it was use the least often in the recounted incidents.

3. Education and the Leadership Frames

Significant relationships were found between use of the structural frame and area of study. CIOs with computer science and business backgrounds used that frame more often than those who specialized in "other" areas. No relationships were found between frame use and major field of study or educational attainment. The human resource frame was found as the most often used regardless of highest degree or major. CIOs with Bachelor's and Master's

degrees reported the political frame as the second most frequently used, while those with doctorates ranked the structural frame second.

4. Employment Background and the Leadership Frames

Respondents with 3 to 5 years of experience as a CIO reported the highest mean scores for each frame, as well as the largest percentage of multiframe leadership (45.8%). Neither analysis of variance (ANOVA) using categorized experience, nor Pearson correlations using years of experience as a continuous variable, revealed any significant relationships between years of CIO experience and frame use.

Those with the most experience in higher education also reported multiframe leadership more frequently. Becker (1999) relates this finding to findings that correspond in a study by Woodsworth. The breakdown of CIOs: sixteen (33.4%) with 21 to 30 years experience and five (41.5%) of those with 31 to 40 years experience reported three or more frames consistently. These two groups also used the human resource frame consistently. Becker (1999) stated that CIOs with 30 years of experience scored the lowest on the structural frame and, in fact, no individual respondent from this group scored the structural frame as being used consistently.

5. Ages, Gender and Frame Use

No significant relationships were found between frame use and age, although multiframe leadership was reported more frequently by CIOs age 50-

54(33.4%) than any other group. More males (28.4%) than females (22.7) reported frame use consistent with multiframe leadership as well. No significant correlation was found between gender and the number of frames used; however significant relationships were found between gender and use of the structural and human resource frames. Male CIOs reported significantly greater use of the structural frame than their female counterparts, while women outscored men in the use of human resource frame. Becker (1999) cautions in the interpretation of this result due to the low relative number of female participants in this study.

6. Role of the Chief Information Officer

Becker's secondary goal in her study was to create a current profile of the organizational role and responsibilities of chief information officers. She accomplished this through the evaluation of job descriptions obtained in the third phase. The job descriptions were coded for evidence of the four leadership frames and responses to Part II of the survey instrument were compiled and compared with earlier CIO studies by Penrod et al., (1990) and Pitkin (1994).

a) Institutional Expectations

Many of the job descriptions outlined a change agent role for the CIO as well as expectations for multiframe leadership. Thirty-three jobs evidenced the structural frame, often using descriptors like planning, developing, implementing, and maintaining. The human resource frame was apparent in twenty-five job descriptions with reference to communication, team building, and

staff development responsibilities. Evidence of political frame was identified in twenty-one job descriptions with words like, liaison and working towards consensus. The symbolic frame was cited least often with only twelve mentioning vision and cultural issues (Becker, 1999).

b) Areas of Responsibility

The analysis of the surveys indicate that most CIOs continue to have responsibilities for academic (74.8%) and administrative (93.1%) computing, although the former has decreased sharply from the 89.7% in the study done by Penrod et al. (1990). Other areas for which CIO responsibility has decreased include: copy/reprographic services (17.2% to 5.4%), institutional research (19% to 5.3%), and mail services (17.2% to 8.4%). Areas of increased responsibility include media services (25.5% to 34.4%), planning (32.8% to 45.8%), and television services (27.6% to 38.2%).

c) Functions

In Becker's interviews with the CIOs they stressed the importance of human resource management as well as vision, communication/liaison, planning, and technical expertise. Providing a vision for technology was the function most frequently cited, with 11 respondents making explicit reference to it. The findings from the interviews differed from Penrod et al.'s (1990) report, as they ranked the top functions in the following order of frequency: leadership,

planning, communication/liaison, provide vision, manage budget, and coordination.

d) Activities

All CIOs interviewed listed planning and strategizing as one of the top four activities of their job. The next most frequently cited activities were: human resource management, keeping current, and communication/liaison. The interviewed CIOs appeared to be acutely aware of the importance of communication, as well as of the need to work with diverse and often competing constituencies. In comparison to Penrod et al. (1990) reported CIO activities as: human resource management, planning/strategizing, vendor relations, meetings, budgeting, and keeping current. Communications/liaison or politically related activities were not mentioned.

e) Characteristics and Leadership Style

The most important characteristics as mentioned by the CIOs remained constant with that of Penrod et al.'s (1990) report. The characteristics are: communication and interpersonal skills; technical competence and knowledge; vision for information technology; and good general management skills. The interviewed CIOs described themselves as human resource or structural leaders. Some also mentioned symbolic leadership, but none explicitly described themselves as political leaders.

f) Reporting Structure and Board Meetings

Most CIOs report to an administrative vice president (39.7%), with a decreasing percentage (25.2%) reporting directly to the president. This is a noted trend in higher education as noted by Pitkin in 1994 report. Seventy-two CIOs (55%) also indicated that they attended Board of Trustees or Regents meetings, although regular attendance was reported by only 29.8%. Most of the CIOs (33.6%) serve as a resource person to the Board, reflecting a decrease from 42.5% reported in Pitkin 1994 report.

g) Technology Committees

Institutional committees were reported in 74%(97) of the respondents, with their role on that committee described as chair (27.5%), member (26%), or "ex-officio" (17.6%). These results compare with Penrod et al.'s (1990) earlier reported 93.1% (54) indicated that their institution had a technology committee functioning either as a policy-making group (33.3%) or as an operational and policy-making group (61.1%).

D. SHAPING CIO AGENDAS IN AN 'E' WORLD

GartnerGroup's findings on the mutating species of the CIO are presented as reported in the findings document.

1. Issues Rising on the Horizon

a) Economic and Industry

- Public policy issues (social policies, privacy, regulations)

- The new economics around investor and capital expectations

b) Technological

- Mainstream Internet use on a nearly global basis
- Untethered and wearable computing
- The emphasis on security in an online world

c) Organizational

- The difficulties of effecting change in organizational culture
- Balancing organizational change concurrent with achieving expected business outcomes
- Innovation and new business development opportunities

d) Executive

- Executive team education (for adequate e-and IT fluency)
- Managing attention (attention-deficient investing)
- Managing personal professional development
- CIO succession planning (GartnerGroup, 2000)

These various challenges emphasize that in the world of CIOs different species are emerging. We can no longer refer to " the role of the CIO," as in fact there are multiple roles. The nature, emphasis and responsibilities of the role

among and between organizations and in the same organization over time vary considerably.

2. The CIO: A Mutating Species

GartnerGroup (2000) puts forth that the role of CIO is "mutating into several quite-distinct patterns or species." These species, or combinations of species in enterprises, evolve based on a series of factors. At a nonspecific level, these factors include the scope in which a CIO is focused on demand and/or supply management as mentioned in the research and the nature of their enterprise drivers and initiatives. There are a number of organizational and situational or temporal factors that help influence the specific CIO species that should exist in a specific enterprise. These organizational and situational factors include: Current investment climate, Value discipline, competitive positioning, enterprise and IS governance requirements, geography and political scope, predominant culture and locale of the headquarters base, perceived and actual organizational capabilities, maturity in use of IT, perceived successes or failures in realizing the business benefits from IT, nature of technology in place, enterprise size, enterprise industry and line of business.

GartnerGroup (2000) states that the possible combinations and patterns for these roles are countless.

3. Functional Head, Strategic Partner or Business Visionary?

GartnerGroup (2000) drew on the three role types used by Ross and Feeny in their work at the Sloan School of Management. Table 4.12, Changing CIO Roles, synthesizes the changing roles of CIOs and distinguishes the different patterns. No particular roles or characteristics are necessarily better than others. It is suggested by GartnerGroup (2000) that CIOs review this table and indicate where they and their enterprise are represented in each row.

	Mainframe Era: Conventional Plus	Distributed Era: Transitional Shifting	Web-Based Era: Hybrid, Emergent
CIO Role	*Functional Head* Operational Manager	*Strategic Partner* Expectation Manager, Technology Advisor, Informed Buyer	*Business Visionary* Business Innovator, Technology Opportunist
Executive Perspective	IT for Cost Displacement	IT Governance Better Focus on Alignment	IT + Internet Viewed as Transfomational. Strategy Driver
Executive Behavior	From Enthusiam to Cost Consciousness	Polarized: Minimize IT Cost vs. Strategic Asset	Invest in IT for New Business/Channels, Cut Time to Market
Portfolio Focus	Transaction Processing Order Through to Delivery	Process Re-engineering, ERP, Knowledge Work, Inter-Organizational Systems	E-Commerce, CRM, Supply Chain Management, Virtual Organization
Dominant Suppliers	IBM	Desktop, ERP, Outsourcers	Network Product Firm, Browser/Portals, e-Business Service Firms
Key CIO Responsibility	Deliver on Promises	Align IT with Business	Drive Strategy
Demand/Supply Focus	Supply Oriented	Demand + Supply	Demand-Oriented
Business Input	Advisor On "How To," Not "What To Do"	Access to Executive, Invited "Seat at the Table"	Key Part of Executive, Assumed "Seat"
Sample Titles	IT Director, Manager - IT Services	CIO, GM - Information Services, Chief Technology Officer	CIO, Technology Strategist, GM - e-Business/Services, Tech. Opportunist
Key Tasks	On-Time Delivery, Reliable Operations	Manage IS Organization, Deliver Infrastructure, Manage IT Staff, Develop Alliances	Develop Business Model, Leverage Extra-Structure, Stimulate Business Executives

Table 4.3 GartnerGroup and Feeny & Ross (1999) Mutating CIO Species

4. Agendas and Mutating Species

To review personal and enterprise priorities, GartnerGroup (2000) suggests that one should review the models developed in chapter III in relationship to the Leadership, Management and Technology agendas. If you

take the two models and superimpose them on each other then the World of the CIOs is complete. Then the CIO can review where their priorities and interests lie. To what extent do the CIO responsibilities relate most to the Leadership and/or Management agendas? Or are your responsibilities more in the Technology agenda, with the additional requirement to ensure capabilities from the Leadership agenda? In midsize to large enterprises GartnerGroup (2000) points out that there is now a cluster of executives with predominantly IT or business-and-IT-fusion responsibilities. The cluster represents a number of species of the genus CIO. The role and responsibilities are diverging. But each of those divergent species is required to stimulate and deliver IT-enabled capabilities. The responsibilities of demand-driven (customer focused) CIOs and business visionaries are increasingly hard to distinguish from other business executives. However without strong supply-oriented leadership (organizational/business focus), the delivery of enabling IT capabilities is jeopardized and strategic and business initiatives cannot be realized.

"Successful IT executives have a clear understanding of their enterprise agenda and their role and responsibilities in achieving that agenda. Their executive colleagues have similar perceptions of that role and responsibilities. Where this is not the case, the shift in role - or the increasing dimensions of the role - is not sufficiently appreciated. It is part of the ongoing challenge of leadership to develop the understanding in others that today there are multiple

agendas facing the mutating species, the CIO. The enterprise needs to have a range of capabilities to fulfill essential and difficult roles and responsibilities" (GartnerGroup, 2000).

E. CORE COMPETENCIES OF THE NAVY MEDICAL CHIEF INFORMATION OFFICER

The findings of Moszkowicz's research define the role of the civilian and DoN Chief Information Officer's responsibilities, critical success factors and core competencies. The results of these findings are then combined to derive the responsibilities, critical success factors and core competencies for the Navy medical Chief Information Officer. The last finding Moszkowicz presents is a measurement for each of the core competencies, which were developed through an interview process with prior and current CIOs. These findings are presented in the following section.

1. Responsibilities of the Civilian Medical Chief Information Officer

- Align the IS function and activities with the organization's strategies
- Strengthen the role of CIO in the organization;
- Create, alter and manage the composition and characteristics of the IT asset;
- Make clinical information systems more useful and relevant to clinicians;

- Facilitate the transition to the Integrated Delivery Network;
- Develop methods to handle security, privacy and confidentiality concerns.

a) Align the IS Function and Activities With the Organization's Strategies

To properly align the IS function with an organization's strategies requires buy-in from and shared decision making among the CEO, top executives, and the rest of the organization. Alignment is not about vision statements or goals that the IS and non-IS executives are attempting to attain. Alignment is about process, and what management does to achieve its goals.

b) Strengthen the Role of CIO in the Organization

Strengthening the role of the CIO within an organization is closely related to aligning the IS function and activities with an organization's strategies. Information technology and the CIO are integrators of the continuum of care. As the decentralization of IT and the growth of end-user computing continue, IT increases in strategic importance for health care organizations and as such requires input and direction format the CEO and the organization's top management. The key to strengthening the role of the CIO is developing an excellent working relationship with the CEO and the organization's senior management team.

c) Create, Alter and Manage the Composition and Characteristics of the IT Asset

The IT asset is strategically important for health care because it can advance strategies in several ways. It can reduce expenses and improve productivity at the same time. It can improve decision-making by reducing errors and shrinking decision-making time. As an enabler of complexity, the IT asset can strengthen or transform inter-organizational relationships. The IT asset can monitor critical activity in the organization, enable customization and differentiation, and improve organizational coordination.

d) Make Clinical Information Systems More Useful and Relevant to Clinicians

Making ISs more user friendly for clinicians involves broad clinician involvement in the selection and implementation of the ISs from the initial stages of development, considering in advance how the system will affect routine practice patterns, and designing interfaces that are intuitive and customized for the user. Expert and artificial intelligence systems can adapt to each clinician's clinical practice patterns and to an algorithm they use in their practice. While some clinicians prefer to see laboratory results first, and others want to see vital sign first. The system should be able to anticipate the clinicians practice patterns and offer options for viewing data the way each clinician desires to see it. New technologies such as voice recognition offer promise in clinical settings whatever

the necessary technology is, it needs to be designed to function in the clinical environment if it is going to be accepted and used by clinicians.

e) Facilitate the Transition to the Integrated Delivery Network

The CIO is responsible for managing the infrastructure portion the application/infrastructure (A/I) architecture. Infrastructure is the underlying base technology used to develop and operate application systems. It also includes the technical and management strategies and tactics utilized to ensure the platform achieves its goals. Infrastructure decisions occur every time a new system or technology enters the environment. Forming infrastructure architecture strategies is a complex conceptual exercise requiring skill in systems analysis and systems thinking.

f) Develop Methods to Handle Security, Privacy and Confidentiality Concerns

Health care CIOs have determined that the most significant threats to patient information can come from inside the patient care institution, with secondary user settings, or from outside intrusion into medical ISs. Inside the patient care institution; accidental disclosures, insider curiosity and insider subordination are significant threats. Accidental disclosures occur when hospital personnel make innocent mistakes that cause unintentional disclosures.

Security breaches from within secondary user settings involve uncontrolled secondary usage of patient information. In this scenario, a secondary user has a legitimate right to access patient data for a particular purpose. However secondary user employs the data for uses not envisioned on patient consent forms, such as for data mining. Secondary users include insurers, employers, and others in the health services industry.

2. Core Competencies of a Civilian Medical Chief Information Officer

The author used the critical success factors to develop a set of core competencies for the civilian medical CIO. The core competencies identified for a civilian medical CIO to be successful are: technical competence, health care business competence, management competence, leadership competence, systems thinking competence, communication competence, and change management competence.

a) Technical Competence

Technical competence is the primary core competency of a civilian medical CIO. The CIO is the custodian and manager of the IT asset. To manage an IT asset the CIO must understand its composition and characteristics, identify how it contributes to the goals of the organization, and assess its performance. To accomplish these goals takes the intimate involvement of the CIO in technology and that takes technological competence.

b) Health Care Business Competence

Healthcare business competence requires knowledge of two unique but interrelated aspects of the healthcare field. These areas are the business aspect of health care and the clinical aspect of healthcare. Each of the two areas has its own knowledge base and language but both are an intimate part of the health care business environment. Knowledge and ability to communicate in each area is an essential part of the health care business competence.

c) Management Competence

The management competence concept has three aspects:

1. financial management skills;
2. customer awareness focus and skills;
3. personnel management skills.

The first aspect involves skills and knowledge of the tools necessary to understand cost benefit analysis, return on investment, risk management, and performance and results based management kind of functions and analysis. This aspect of management competence enables the manager to effectively evaluate his area of responsibility in financial terms. The second aspect of management competence involves using the financial management evaluations discussed above to make strategic competence. Customer awareness skills are necessary to this aspect of management competence. The third aspect of management competence deals with the skills, evaluate, train,

and develop personnel. This aspect of management competence deals with the personnel aspects of management. To have management competence means the CIO is proficient in all three areas.

d) Leadership Competence

The author used five characteristics of a leader developed by Bennis to discuss leadership. The first characteristic of a leader is that they have a strong sense of purpose, a passion, and a sense of wanting to do something meaningful to make a difference. A leader can create a vision and share it. The second characteristic is that a leader is capable of developing and sustaining rich and trusting relationships. A leader has integrity and is caring and authentic with people. His followers do the right thing. The third characteristic of a leader is that he is a provider of hope and his followers have a sense that, whatever it is, they can do it. The fourth characteristic of a leader is that he keeps a balance in his life between work, family and outside activities. The fifth characteristic is that a leader has a bias towards action. Although not reckless, a leader does not hesitate to take risks. (Bennis, 1996) A leadership competence encompasses all of these five characteristics.

e) Systems Thinking Competence

Every one of the CSFs deals with a complex set of interrelated systems. To understand systems, one needs to understand the underlying patterns of the systems. The author uses Senge as a reference to explain the

definition of systems thinking. Senge calls "systems thinking" or the "fifth discipline" and it is one of his five basic learning disciplines (Senge, 1990).

The author explains that Systems thinking is a discipline for seeing wholes. It is framework for seeing interrelationships rather than linear cause and effect chains and seeing processes of change rather than snapshots in time. It involves understanding both reinforcing and balancing feedback processes and understanding delays. Reinforcing feedback processes are the engines of growth. Complex systems contain many combinations of reinforcing feedback, balancing feedback and delays. The goal is to understand the patterns of complexity (Senge, 1990).

f) Communications Competence

Good communications skills are essential for every executive and have relevance for each critical success factor.

g) Change Management Competence

The world of medicine is literally exploding with new and expanding technologies that are revolutionizing the delivery of health care. It seems as though almost everyone in business and government has some need for data from the health care world, either as patients, payers, or for research. The CIO is at the center of these colliding vortices and things are changing rapidly and in many dimensions. In order for the CIO to survive in this rapidly changing

environment and to successfully meet their critical success factors the CIO must have change management skills.

Change management skills involve the ability to recognize change and its consequences, to plan change effectively and to manage change and its consequences. The Change management process has several aspects:

- setting goals and designing a desired future state;
- diagnosing the present condition in relation to future goals;
- defining the transition state and the activities required to meet the future state;
- developing strategies and action plans for managing the transition.

3. Responsibilities of A Department Of Defense Chief Information Officer

There are seven major responsibilities of the Navy CIO. Most respond to temporal factors and come directly from the ITMRA mandate and therefore have a basis in law. The six critical success factors for the Navy CIO are:

- develop and sell a strategic plan
- implement an information technology architecture that supports the strategic plan;
- set goals for information technology within the Department of the Navy;

- manage and establish credibility for information resource management within the Department of the Navy;
- increase the technological maturity of the Department of the Navy; and
- participate and guide the chief information officer council (Frew, 1997).

a) Develop and Sell a Strategic Plan

ITMRA mandates the development of a strategic plan so the DoN CIO must be able to develop and sell an IM/IT strategic plan. The IT strategic plan must be integrated with the Navy and DoD strategic plans and the DoD IT strategic plan. To develop a strategic plan for IM/IT in the Navy, the DoN CIO must be able to articulate a vision, put it in terms that are understandable to the people in the organization, develop a core group of believers and sell the vision while developing a critical mass.

b) Implement an Information Technology Architecture that Supports the Strategic Plan

An IT architecture is the "set of design criteria, implementation rules and technical standards that governs the design, deployment an operation of all information technology and systems in an organization." Building a comprehensive enterprise wide MIS is not practically feasible because it costs too

much, takes to long and does not meet the needs of the constantly changing environment of the DoD (Hoffman, 1994).

The author discusses the need to split the architecture into the application/infrastructure (A/I) architecture. This approach divides the architecture into segments of applications and infrastructure. Applications are systems that deliver the information needed to run an enterprise. They may support a business process or a functional organization but most likely they support both. Applications contain the elements of the IS that are unique to a businesses processes and activities. Infrastructure in an A/I architecture consists of all facilities and programs that can support more than one activity or process. It includes all the resources used to construct, connect and support applications except what is unique to each application. Infrastructure contains four elements:

- the computer and communication network;
- data;
- technical tools and administrative procedures;
- people. (Hoffman, 1994)

c) Set Goals for Information Technology Within the Department of the Navy

ITMRA mandates that each agency CIO integrate IM/IT planning and management process with the business process, capital planning, and acquisition. To meet congresses requirement for productivity improvements in

the Navy the DoN CIO needs to set IT goals as a portion of the implementation of the strategic plan. In order to set these goals the DoN CIO must have an understanding of the technological issues involved, in DoD acquisition process, the business processes in the DoN, DoD and the private sector, people and change management tools such as capital planning, return on investment (ROI) and performance and results based management.

d) Manage and Establish Credibility for Information Resource Management Within the Department of The Navy

The Paperwork Reduction Act of 1995 requires the DoN CIO to manage resources to improve public access to information. The Clinger-Cohen Act requires the DoN CIO to assess agency personnel knowledge and skills in IRM and develop plans to address workforce IM/IT competency requirements.

e) Increase the Technological Maturity of the Department of the Navy

As technology matures, it becomes easier and cheaper for an organization to take advantage of computer and telecommunication innovations and applications throughout the organization. Technology professionals must help users adapt to new technologies, use technology in innovative ways, understand and use technological tools, and build systems without IRM help.

This requires the IRM staff to have adequate infrastructures and support for those products and projects (Moszkowicz, 1997).

f) Participate and Guide the Chief Information Officer Council

Clinger-Cohen Act and President Clinton's Executive Order 13011 require the Department of the Navy Chief information Officer participate in the Chief Information Officer Council. Participation in a legislatively mandated council of peers requires management and political competencies. The CIO council is an excellent forum for the DoN CIO to work with other CIOs to share best practices, lessons learned, and sponsor cooperation in using information resources.

4. Core Competencies of a Department of Defense Chief Information Officer

The author discusses the same competencies as the civilian medical CIO with only regulatory constraints and requirements being the only differences. The competencies listed are:

- Political Competence
- DoD Business Competency
- Communication Competence
- Management Competence
- Technological Competence

- Leadership Competence
- Change Management Competence

5. Survey of Navy Medical Chief Information Officers

a) Demographics

Moszkowicz (1997) reported that the respondent's age ranged from 30 to 52 years with a mean age of 37.5 years. Seventy-five percent of the respondents were male. Year's experience of DoD IS/IT ranged from two to twenty years with a mean of 10.35 years.

The majority of the respondents in Moszkowicz's survey identified 36 of the 53 core competencies were necessary for a DoN CIO to be an effective member of the executive team. All respondents in the survey identified communication skills and leadership as core competencies. Ninety percent of the respondents identified the core competencies of customer awareness, knowledge of the health care business, life cycle management, partnership and team building, and planning as necessary core competencies. Project management skills and vision were identified by eighty-five percent of the respondents while acquisition knowledge, benchmarking, capacity planning, change management, information resource management, staff development, strategic management, and technology integration skills were named by eighty percent of the respondents (Moszkowicz, 1997).

The remaining breakout scoring for the core competencies: Seventy-five percent of the respondents chose baseline assessment/analysis, business process reengineering/improvement, knowledge of computer standards, contingency planning, contracting knowledge, cost-benefit analysis, performance measurement, return on investment, and the skills associated with making a source decision by comparing the benefits of making versus buying as necessary core competencies of DoN medical CIO. Risk analysis knowledge and staff evaluation sills were named by seventy percent of the respondents while sixty-five percent chose capital investment and planning, process quality improvement, risk management and technological competence as core competencies. Sixty percent of the respondents named knowledge of best practices IS development and implementation, and organizational development as necessary core competencies. Finally fifty-five percent of the respondents chose organizational performance as a necessary core competency of a DoN medical CIO (Moszkowicz, 1997).

6. Core Competencies of a Navy Medical Chief Information Officer

Moszkowicz (1997) describes the differences between the civilian and military CIOs. Those differences add a layer of complexity and uncertainty when determining requirements to succeed in the role of CIO. If a military CIO is called to a temporary operational duty during their tour at a hospital then in their

absence an activate reservist or possibly a civilian would be put in the CIO's position.

Although lower in the chain of command Moszkowicz (1997) noted that the Navy medical CIO needs to have the same knowledge and skills as the DoN CIO concerning IM/IT budgeting, acquisition and finance.

The list of core competencies that Moszkowicz (1997) developed for civilian and DoD CIOs are very similar. Moszkowicz (1997) states his case that the Navy medical CIOs core competencies are a combination of the two. Figure 4.3 shows the comparisons of the different CIO's core competencies.

Another important area of Moszkowicz (1997) study addresses the issue of the hierarchical position of the CIO. The results are from the survey of military information systems and technology professionals that attended DoN CIO Conference/CHIME "Information Management Executive Course," Cleveland, Ohio, June 1997, in which they reported their reporting level within their respective commands. The results of the reporting levels was: Seven individuals carry the title of CIO, only one reports directly to the CO while one reports to the executive officer. The remaining ten individuals that respond to the title of CIO report to the Director for Administration (DFA). The members that report to the CO and XO are both members of their command's executive steering committee (ESC); these two definitely fulfill the role of CIO. Four of the ten reporting to the DFA are members of their command's ESC; these are considered CIOs.

The other six are what Moszkowicz (1997) calls "emerging CIOs."

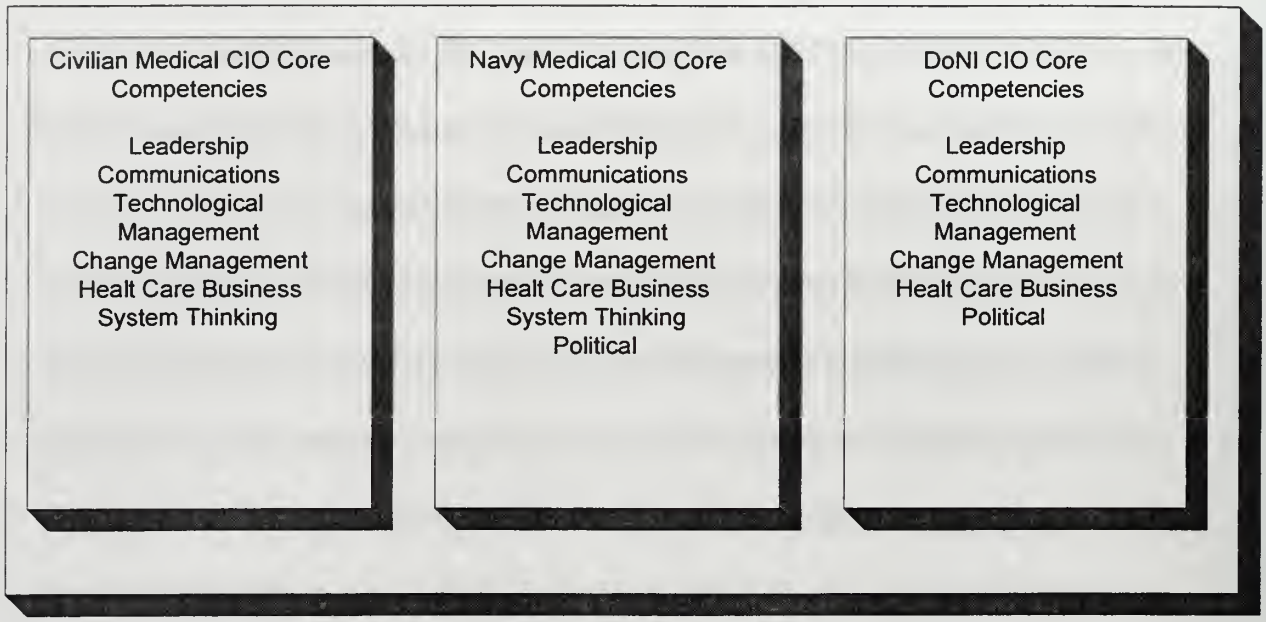

Figure 4.3 Moszkowicz's (1997) CIO Core Competencies

7. Measures of Effectiveness (MOE) of Navy Medical Chief Information Officer

The development of the following measurements of effectiveness was a result of the author's interviews with twenty-one former, current and potential Navy medical CIOs. The following measures of effectiveness were identified:

a) Leadership Competence Measures of Effectiveness

MOEs include evaluating the CIO plan, then measuring how well the IT strategic plan aligns with the business plan, and how well it is implemented. The measure of how well the IT strategic plan is written and

aligned with the organizations strategic plan can be obtained through polling of the CO and Executive Steering Committee (ESC).

b) Communication Competence Measures of Effectiveness

A MOE for this competence is to ask users to define a particular topic concerning the area of IM/IT and then compare the users' definition with the CIO's definition. This exercise would provide a metric of how effective the information and explanation of IM/IT related and how the user community interprets those topics. This measure would also address the need for education through different avenues to enhance the learning process.

c) Technological Competence Measures of Effectiveness

The MOE for this competence is in three areas, create an agile IT infrastructure, provide accurate, high quality data, and IS staff expertise essential in the medical department. Each of these areas can be measured through customer surveys.

d) Management Competence Measures of Effectiveness

The CIO's MOE for this area is capital planning and investment and return on investment where it is applicable in their environment. Customer awareness and response MOE measurement is through a survey process. The response time can be monitored through accurate documentation of actual response time. The last area of the Management competence is staff and

organizational development. This area has several avenues to capture data (e.g. surveys, tests, presentations etc...) on the effectiveness of the IM/IT staff training and development program.

e) Change Management and Systems Thinking Measures of Effectiveness

The MOE for this area is the customer satisfaction of the product and/or service provide and measured over time to see if implementation or a change was effectively handled.

f) Department of Defense Health Care Business Competence Measures of Effectiveness

The CO and ESC members are the ones best to measure this competence. The MOE for this area requires only asking the CO and ESC for their input on their ability to meet the organizations need. Another avenue is a 360-degree evaluation conducted by superiors, peers and subordinates to provide feedback on the CIO's effectiveness.

g) Political Competence Measures of Effectiveness

The author did not provide a measure other than the ability to assert power and influence those higher than their rank or organizational position.

8. Summary

Moszkowicz (1997) presented the CSFs to assist in defining the CIO's essential conditions for success. Through the examination of the CSFs Moszkowicz (1997) developed a set of core competencies. He concluded that by monitoring the success of the CIO at meeting each of the core competencies one could ultimately determine the CIO's effectiveness at the executive management level. Through the measures of effectiveness the CIO and those involved in the leadership can measure the impact the CIO in the organization.

F. DEVELOPING A CORE COMPETENCY MODEL FOR INFORMATION SYSTEMS MANAGEMENT OFFICERS IN THE UNITED STATES ARMY, "THE ARMY'S VERSION OF THE CIO"

As mentioned in the previous chapter, this study is being presented to show the similarities in the core competencies for the CIO as it is represented in different cultural and organizational environments. This study examined the core competencies for FA 53 officers. The objective was to identify the competencies and develop an education program that supports these competencies. To do this the authors took a critical look at the historical and current programs of study at the Signal Corps' System Automation Course and the Army's Advanced Civil Schooling education program.

The dynamic nature of technology requires a continual process to stay up to date with the changes. It was noted by the authors that the Clinger-Cohen Act

of 1996 and the formation from the CIO University provided complementary efforts by the DoD to address the needs for competency based education and support our findings below (Hunt & Willhelm, 2000).

1. **What exactly are the Core Competencies of the Army's System Automation Officer (Functional Area 53)?**

(Consensus) Based on feedback from the focus groups the following modifications to the original competency model were made.

- Leadership
  Applies the dimensions of Army leadership and values
- Developing Others
  No Change
- Initiative
  Is proactive in all matters under their control
- Impact and Influence
  Is proficient in both written and oral communication
- Achievement Orientation
  Focused on the customer and their satisfaction
- Teamwork and Cooperation
  No Change
- Analytical Thinking
  No Change
- Self Confidence
  No Change
- Directiveness/Assertiveness
  No Change
- Information Seeking
  No Change

- Conceptual Thinking
  No Change
- Project Management
  No Change
- Technical Knowledge
  No Change (Hunt & Willhelm, 2000)

2. **Using the Core Competency Model, What are the courses that should be taught in the SAC Course and in Graduate School which cover all Core Competencies of the System Automation Management Officer?**

This question was too specific for the purpose of this thesis. Although the information provide by the process did provide valuable information for this research.

The Information Systems Management Officer Competency Model provides the knowledge, skills and attributes the system automation management officer should possess. From these knowledge, skills, and attributes an education program is developed that will ensure the officer is prepared to serve as a systems automation professional who can apply their knowledge of computing technology and its applications to the digitization of the US Army. The program of study consists of a computing and information systems based curriculum that provides a foundation in both technical concepts and systems design (Hunt and Willhelm, 2000). The program of study includes:

TECHNOLOGY:

Software Engineering

Networks and Communications Systems

Decision Support Systems

Database

Information Assurance

Modeling and Simulation

OPERATIONS:

Command and Control

C4ISR Systems

Information Operations \ Information Warfare \ C2

Operational and System Architectures

Combat Models and Simulations

MANAGEMENT:

C4ISR Systems Evaluation

Acquisition of Information Technology

Systems Analysis and Design Process

Software Engineering Management

Enterprise Management

Information Technology Investment Strategy (Hunt & Willhelm, 2000)

Information Systems Analysis and Design - This course teaches the tools and techniques of requirements analysis using process-oriented and data-oriented techniques. These methodologies focus on re-engineering, re-

structuring, and simplifying work methods and procedures. Topics include: evaluation of alternative design options; cost-benefit analysis; quality assurance; documentation and systems implementation. Rapid prototyping and computer-assisted software engineering approaches are also examined (Hunt & Willhelm, 2000).

Database Design - This course provides knowledge of enterprise-wide data modeling, logical database design, and the management of data resources to support multiple functions. The primary focus is on how data resources are identified, planned, implemented, and merged in order to generate management reports. Topics include: relational database theory; distributed database systems; semantic data models; query processing; transaction management and recovery (Hunt & Willhelm, 2000).

Management of Information Systems Development - This course is designed to focus on planning strategies and the management and control of information systems development projects. It addresses the planning and acquisition of hardware, peripherals, telecommunications equipment and software. Topics include: systems development life cycle; rapid prototyping; use of software packages; and information engineering with data-driven techniques (Hunt & Willhelm, 2000).

Computer Networking - This course teaches structure and architecture of computer networks. The fundamentals of the OSI model are covered as well

as examples of various local area networks. Existing communication protocols are also studied. Topics include: TCP/IP; IP management; routers; packet switching (Hunt & Willhelm, 2000).

Computer Systems Architecture - This course provides an overview of basic computer hardware concepts and operating systems. Topics include: data representation; processor and processor management; memory management; input/output processors and techniques; intra-system communication; microprogramming, parallelism and pipelining (Hunt & Willhelm, 2000).

Software Engineering - This course focuses on the specification, design, testing, maintenance and management of large software systems. Topics included: structured design; structured programming; top-down design and development; segmentation and modularization techniques, iterative enhancement; design and code inspection (Hunt & Willhelm, 2000).

Data Communications - This course studies the theory, design and operation of analog and digital communication systems. Topics include: analog/digital conversion; modulation; demodulation; frequency division multiplexing and time-division multiplexing (Hunt & Willhelm, 2000).

Computer Security - This course is intended to provide students with the importance of protecting data in communications between computers-based information systems. It will present security standards, certification, and accreditation standards (Hunt & Willhelm, 2000).

Principles of Programming Languages - This course is an introduction to the design, evaluation and implementation of programming languages. Imperative functional, logic, and concurrent programming methodologies are investigated. Languages to be studied: Ada; C++, Visual basic; Java (Hunt & Willhelm, 2000).

G. UNITED STATES DEPARTMENT OF LABOR: BUREAU OF LABOR STATISTICS COMPUTER AND INFORMATION SYSTEMS MANAGERS (11-3021.00) AND O*NET ONLINE

This section lays out the requirements that the Bureau of Labor Statistics and O*Net Online has concluded through a survey and analysis process that describes the CIO. The O*Net database includes information on job zone component, abilities, occupational-specific information, skills, work values definitions, generalized work activities definition interests, and knowledge associated with occupations (O*Net, 2000). This information can be used to facilitate career exploration, vocational counseling, and a variety of human resources functions, such as developing job orders and position descriptions and aligning training with current workplace needs.

Job Zone Component	*Job Zone Component Definition*
	Job Zone Five: Extensive Preparation Needed
Overall Experience	Extensive skill, knowledge, and experience are needed for these occupations. Many require more than five years of experience. For example, surgeons must complete four years of college and an additional five to seven years of specialized medical training t
Job Training	Employees may need some on-the-job training, but most of these occupations assume that the person will already have the required skills, knowledge, work-related experience, and/or training.
Education	A bachelor's degree is the minimum formal education required for these occupations. However, many also require graduate school. For example, they may require a master's degree, and some require a Ph.D., M.D., or J.D. (law degree).
*SVP Range	(8.0 and above) 4 to 10 years of education.
Job Zone Examples	These occupations often involve coordinating, training, supervising, or managing the activities of others to accomplish goals. Very advanced communication and organizational skills are required. Examples include athletic trainers, lawyers, managing editor
	*Occupations are assigned to one of the five O*NET Job Zones based upon how much overall experience, education, and on-the-job training people need to do them. Occupations with similar experience, education, and training requirements are grouped together into one of five job zones.*

Table 4.4 Bureau of Labor Statistics (2000) Job Zones

Work Values	*Work Value Definitions*
Independence	Occupations that satisfy this work value allow employs to work on their own and make decisions. Corresponding needs are Creativity, Responsibility and Autonomy.
Achievement	Occupations that satisfy this work value are results oriented and allow employees to use their strongest abilities, giving them a feeling of accomplishment. Corresponding needs are Ability Utilization and Achievement.
Working Conditions	Occupations that satisfy this work value offer job security and good working conditions. Corresponding needs are Activity, Compensation, Independence, Security, Variety and Working Conditions.
Recognition	Occupations that satisfy this work value offer advancement, potential for leadership, and are often considered prestigious. Corresponding needs are Advancement, Authority, Recognition and Social Status.
Relationships	Occupations that satisfy this work value allow employees to provide service to others and work with co-workers in a friendly non-competitive environment. Corresponding needs are Co-workers, Moral Values and Social Service.
Support	Occupations that satisfy this work value offer supportive management that stands behind employees. Corresponding needs are Company Policies, Supervision: Human Relations and Supervision: Technical.

Work Values are global aspects of work that are important to a person's satisfaction.

Table 4.5 O*Net Online and The Bureau of Labor Statistics (2000) Work Values

Occupation-Specific Information
Evaluates data processing project proposals and assesses project feasibility.
Prepares and reviews operational reports or project progress reports.
Develops performance standards and evaluates work in light of established standards.
Consults with users, management, vendors, and technicians to determine computing needs and system requirements.
Analyzes workflow and assigns or schedules work to meet priorities and goals.
Meets with department heads, managers, supervisors, vendors, and others to solicit cooperation and resolve problems.
Approves, prepares, monitors, and adjusts operational budget.
Develops and interprets organizational goals, policies, and procedures, and reviews project plans.
Directs daily operations of department and coordinates project activities with other departments.
Participates in staffing decisions.
Directs training of subordinates.

This snapshot shows tasks performed in this occupation. Tasks are specific work activities that can be unique for the occupation.

Table 4.6 O*Net Online and The Bureau of Labor Statistics (2000)
Occupational Specific Information

Abilities	*Abilities Definitions*
Oral Comprehension	The ability to listen to and understand information and ideas presented through spoken words and sentences
Oral Expression	The ability to communicate information and ideas in speaking so others will understand
Written Comprehension	The ability to read and understand information and ideas presented in writing
Written Expression	The ability to communicate information and ideas in writing so others will understand
Number Facility	The ability to add, subtract, multiply, or divide quickly and correctly
Mathematical Reasoning	The ability to understand and organize a problem and then to select a mathematical method or formula to solve the problem
Speech Clarity	The ability to speak clearly so that it is understandable to a listener
Deductive Reasoning	The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense.
Near Vision	The ability to see details of objects at a close range (within a few feet of the observer)
Inductive Reasoning	The ability to combine separate pieces of information, or specific answers to problems, to form general rules or conclusions. It includes coming up with a logical explanation for why a series of seemingly unrelated events occur together.
	This snapshot shows the most important Abilities for this occupation. Abilities are enduring attributes that influence performance.

Table 4.7 O*Net Online and The Bureau of Labor Statistics (2000) Abilities

Skills	*Skills Definitions*
Problem Identification	Identifying the nature of problems
Coordination	Adjusting actions in relation to others' actions
Judgment and Decision Making	Weighing the relative costs and benefits of a potential action
Implementation Planning	Developing approaches for implementing an idea
Writing	Communicating effectively with others in writing as indicated by the needs of the audience
Active Learning	Working with new material or information to grasp its implications
Speaking	Talking to others to effectively convey information
Reading Comprehension	Understanding written sentences and paragraphs in work related documents
Management of Personnel Resources	Motivating, developing, and directing people as they work, identifying the best people for the job
Information Gathering	Knowing how to find information and identifying essential information
	This snapshot shows the most important Skills and Knowledge areas for this occupation. Skills are developed capacities that facilitate learning and the performance of activities that occur across jobs.

Table 4.8 O*Net Online and The Bureau of Labor Statistics (2000) Skills

Interests	Interests Definitions
Enterprising	Enterprising occupations frequently involve starting up and carrying out projects. These occupations can involve leading people and making many decisions. Sometimes they require risk taking and often deal with business.
Conventional	Conventional occupations frequently involve following set procedures and routines. These occupations can include working with data and details more than with ideas. Usually there is a clear line of authority to follow.
Investigative	Investigative occupations frequently involve working with ideas, and require an extensive amount of thinking. These occupations can involve searching for facts and figuring out problems mentally.

The Interests are areas that individuals generally like or dislike.

Table 4.9 O*Net Online and The Bureau of Labor Statistics (2000) Interests

Generalized Work Activities	Generalized Work Activities Definitions
Getting Information Needed to Do the Job	Observing, receiving, and otherwise obtaining information from all relevant sources.
Updating & Using Job-Relevant Knowledge	Keeping up-to-date technically and knowing one's own jobs' and related jobs' functions.
Guiding, Directing & Motivating Subordinates.	Providing guidance and direction to subordinates, including setting performance standards and monitoring subordinates.
Making Decisions and Solving Problems	Combining, evaluating, and reasoning with information and data to make decisions and solve problems. These processes involve making decisions about the relative importance of information and choosing the best solution.
Coordinating Work & Activities of Others	Coordinating members of a work group to accomplish tasks.
Establishing & Maintaining Relationships	Developing constructive and cooperative working relationships with others.
Developing and Building Teams	Encouraging and building mutual trust, respect, and cooperation among team members.
Communicating With Other Workers	Providing information to supervisors, fellow workers, and subordinates. This information can be exchanged face-to-face, in writing, or via telephone/electronic transfer.
Implementing Ideas, Programs, etc.	Conducting or carrying out work procedures and activities in accord with one's own ideas or information provided through directions/instructions for purposes of installing, modifying, preparing, delivering, constructing, integrating, finishing, or completing programs, systems, structures, or products.
Scheduling Work and Activities	Scheduling events, programs, activities, as well as the work of others.
	This snapshot shows the most important generalized Work Activities for this occupation. Work Activities are general types of job behaviors occurring across many jobs.

Table 4.10 O*Net Online and The Bureau of Labor Statistics (2000) Work Activities

Knowledge	*Knowledge Definitions*
Administration and Management	Knowledge of principles and processes involved in business and organizational planning, coordination, and execution. This includes strategic planning, resource allocation, manpower modeling, leadership techniques, and production methods
Computers and Electronics	Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming
Mathematics	Knowledge of numbers, their operations, and interrelationships including arithmetic, algebra, geometry, calculus, statistics, and their applications
English Language	Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar
Economics and Accounting	Knowledge of economic and accounting principles and practices, the financial markets, banking, and the analysis and reporting of financial data
Education and Training	Knowledge of instructional methods and training techniques including curriculum design principles, learning theory, group and individual teaching techniques, design of individual development plans, and test design principles
Personnel and Human Resources	Knowledge of policies and practices involved in personnel/human resource functions. This includes recruitment, selection, training, and promotion regulations and procedures; compensation and benefits packages; labor relations and negotiation strategies; and personnel information systems
Customer and Personal Service	Knowledge of principles and processes for providing customer and personal services including needs assessment techniques, quality service standards, alternative delivery systems, and customer satisfaction evaluation techniques
Clerical	Knowledge of administrative and clerical procedures and systems such as word processing systems, filing and records management systems, stenography and transcription, forms design principles, and other office procedures and terminology
Psychology	Knowledge of human behavior and performance, mental processes, psychological research methods, and the assessment and treatment of behavioral and affective disorders

Knowledge is organized sets of principles and facts that apply to a wide range of situations.

Table 4.11 O*Net Online and The Bureau of Labor Statistics (2000) Knowledge

H. SUMMARY

This chapter presented the findings from Chapter III studies. The findings provided in this chapter were used to compile the data tables presented in Chapter V which answer the thesis questions.

V. THESIS FINDINGS

This thesis provides the framework for the Navy's transition to the mature learning organization, "an organization that is continually expanding its capacity to create its future" (Senge, 1990). To obtain this vision of the learning organization the Navy has several areas in which they need to focus. The area of focus in this thesis is information technology and management and the identification and development of a clear definition for the CI^2O. For an enterprise or individual to be successful there has to be a roadmap or a methodical approach to getting to an end point. The approach must be reproducible but not identical in each organization. The approach to defining the CI^2O follows in the descriptions below.

A. COMPILATION OF FINDINGS RESULTS

The results of the studies are presented in such a way as to describe the mature learning organization presented in the introduction and Figure 5.1. Descriptions of the areas in the model are explained in each category starting with the organization's environmental situation down to what an individual needs to know to be successful. The discussion is organized as follows: critical success factors or key factors, reporting levels, roles, core competencies, education level and experience. The analysis addresses the mature organization in the same fashion. Before discussing the areas it is important to discuss the methodology of presentation. The methodology for the presentation is to first present the CSFs since they identify the areas that organizations consider important to

meeting the mission. The next level of detail is in the reporting level of the CI^2O. The reporting level will be one of the determining factors along with the CSFs on what role the CI^2O is to operate. The level of education and experience he/she brings into the job determines the success in each role that the CI^2O operates in the organization. As you can see each area or category builds upon the next, until you have defined the requirements for the organization. Once the organization's role is discussed then the individual filling the job can identify what it is they need to know.

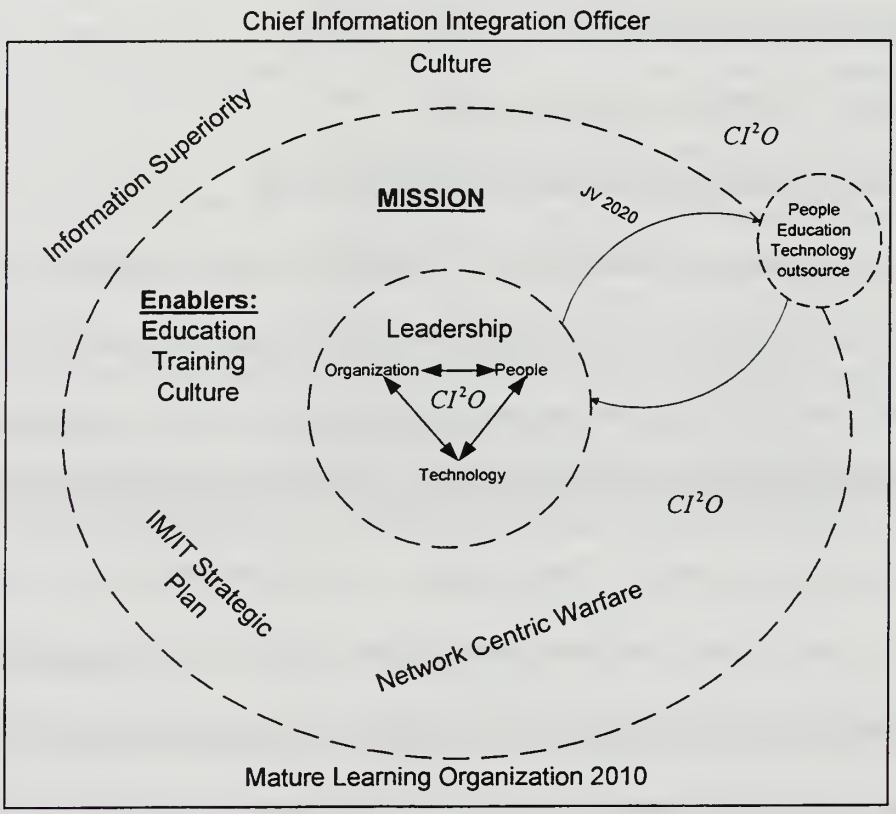

Figure 5.1 Mature Learning Organization Model

1. Critical Success Factors or Key Factors

Figure 5.1 depicts the context of the environment in which the CI^2O works. The vision and mission of the organization are what drives the critical success factors along with the information management governance. The first three items in Table 5.1 are the most critical for the success of the CI^2O. With these three CSFs in place the CI^2O, as mentioned in the GAO study directed by McClure, can function and focus on the remaining CSFs. Moszkowicz in his study defines a critical success factor as an area in a business environment where things must go right for the business and the individual managing that business to succeed. Another way to look at the definition of the CSF is, "a consensus about causes of failure, by those who caused failure" (Strassman, 1995). Critical success factors are those areas that a CI^2O has to perform in, and are measurable to determine his/her effectiveness at the organizational level. The CSFs are defined by that organization in which the CI^2O works.

Critical Success Factors or key Factors
Align IM leadership for value creation (Leadership Responsibility)
Promote Organizational Credibility (Leadership Responsibility)
Strengthen the CIO role (Leadership Responsibility)
Develop and sell a strategic plan
Drive Strategy
Align the IS function and activities with organizations strategies
Develop Business Model
Leverage Extra-Structure
Stimulate Business Executives
Manage IS Organization
Execute IM responsibility
Manage IT Staff
Deliver Infrastructure
Develop & Implement a common IT architecture in support of the strategic plan
Create, alter and manage all IT assets
Make information systems more useful and relevant
Develop methods for security, privacy and confidentiality concerns
Increase the technological maturity
Deliver on Promises
Deliver On-Time
Reliable Operations

Table 5.1 Compiled Critical Success Factors

2. Reporting Levels

The reporting levels are recorded in Table 5.2 as reported in the findings reviewed. The two dissertations by Becker (1999) and Smaltz (1999) showed that from the selected field of CIOs most are one level down. Becker noted a trend from a previous study in education by Penrod (1990) and Pitkin (1994) that the CIOs reporting levels are moving to the second level of leadership (e.g. the vice president, COO, or executive officer). In Moszkowicz' study the interviewees were classified as IS/IT professionals so a CIO focus was not used in the interview process. GartnerGroup (2000) did not report a number but reported

the type of interaction and position the CIO has with the executive board. The reporting level affects the level of the formal involvement or engagement, as discussed in Smaltz's study. Involvement in Strategic decision-making and vision development for IT is important to the success of the CI^2O as well as the transformation into the mature learning organization. If the CI^2O is not able to have an executive level reporting relationship within the organizational structure then he/she needs to at least be part of the executive committee, as a voting member. The results of the compilation of findings are presented in Table 5.2.

Reporting levels	0	1	2 or less	N
Becker	25.2%	39.7%	35.1%	131
Smaltz	17%	77%	4.10%	106*
Moszkowicz	8.3%	8.3%	83.3%	12**
Gartner Group and Ross & Feeny	Key part of Executive, Assumed "Seat"	Access to Executive, Invited "Seat at the Table"	Advisor On "How To," Not "What To Do"	N/A

*Conducted through a focused survey of CIOs
**IS/IT Professionals not CIO Specific

Table 5.2 Reporting Level

3. Roles

The role a CI^2O fulfills is determined by several factors. These factors were put forth in Moszkowicz's temporal factors, Smaltz's TMT/CIO Engagements and GartnerGroup's "Mutating Species" organizational and situational factors. To list a few factors that impact or define the CI^2O's role are the governance that is in place, organizational culture issues, and the results of the past in IM or IT, budget constraints, and changing of leadership. These are but a few myriad

variables that affect the CI^2O's role. This list of factors portrays a position that needs an individual that is flexible and understands the dynamics of change and how to manage it. The different roles a CI^2O carries out are listed in Table 5.3, which were compiled from the studies.

CIO Roles	
Smaltz	**Gartner Group and Ross & Feeny and Ross & Feeny**
Classic IT Support/Utility	Function Head
	Operational manager
Informaticist/IT Strategist	Strategic Partner
IT Educator	Expectation Manager
	Technology Advisor
IT Contract Oversight	Informed Buyer
Business Partner/Strategist	Business Visionary
IT Stategist	Business innovator
Integrator	Technology Opportunist

Table 5.3 CIO Roles

4. Core Competencies

The main focus of Moszkowicz and Hunt and Willhelm's research was the identification of core competencies. As defined by Hamilton Strategic Management Group "core competencies or capabilities are bodies of expertise, organizational skills, or systems, which are perceived by the customer as providing exceptional value." Another definition cited by Hunt and Willhelm is by participants in a management conference in Johannesburg, South Africa which stated, "A competency is a cluster of related knowledge, skills and attitudes (KSA) that affects a major part of one's job (a role or responsibility), that correlates with performance on the job, that can be measured against well accepted standards, and can be improved via training and development (Parry,

1996)." Given these definitions, a competency model then describes the particular combination of knowledge, skills and characteristics needed to effectively perform the role in the visionary mature learning organization. The anthology of competencies for each author of the studies is presented in Table 5.4.

Core Competencies Demonstrating Knowledge and Expertise
Political
Business
Communications
Management
Technological
Leadership
Change management
Industry specific requirements
Systems thinking
Developing others
Initiative
Impact and influence
Achievement Oriented
Teamwork and Cooperation
Self Confidence
Directive/Assertiveness
Information Seeking
Project Management

Table 5.4 Compiled Core Competencies

5. Level of Education

Becker's research was the only study that specifically stated the level of education obtained for the CIO. Smaltz used the TMT survey to express the level of knowledge of the CIO. The level of education is not a significant finding according Becker's research for the role of the CIO. This finding is further supported by a personal interview with Mike Bowman, a government CIO form

the Office of General Counsel of the Department of the Navy, on the requirements for hiring a CIO. The government CIO stated, the degree requirement is to narrow a focus instead, the hiring agency or body should look at a applicants proficiency or demonstrated success in the skill set that the agency is interested in for the position (Bowman, 2000). But as you can observe in Table 5.5 the predominant level of education for a CIO is at the master's level for higher education. For the mature learning organization the level of degree will follow the pattern set forth in the Table 5.5 and by 2010 the overwhelming majority will be master's with a greater percentage of doctorate degrees. To educate and train individuals to operate within the core competencies one would need a combination of education and experience to become proficient in the complex technology world of the future.

Education Level	Bachelor's	Masters	Doctorate
Becker	14.5%	55.0%	27.5%
Smaltz	Based knowledge on leaderships rating		

Table 5.5 Years Education

6. Experience

The level of experience is as important if not more than the education. As a CI^2O has worked in an organization or industry for a period of time he/she is able to understand the information requirements better and have more interaction with the customers of the organization. The relationships required for a success in IM/IT are an important part for the CI^2O. Getting a degree does not guarantee success or the ability to develop relationships. The education provides

the background or foundation for future growth in the development of knowledge through experience. In Becker's study she noted that in higher education experience only had an impact on the frame type used. Moszkowicz reported the years of experience for Navy CIO or IS/IT professionals as 4-20 years with a mean of 10.35 years (See Table 5.6). No other research studies mentioned length of experience.

Experience	Years
Becker	1-40 years
Moszkowicz	4-20 years

Table 5.6 Years Experience

7. Bureau of Labor Statistics and O*Net Online

The O*Net Online and BLS provides a profile that is in place and is comparable to the results of the studies presented. The areas that the O*Net Online and BLS cover are more conclusive on the requirements, role, responsibilities, skills, and descriptive of the education that is required for the CI^2O than those found in the studies. This conclusion answers the research questions provided and is supported by the findings of the studies presented above. Full definitions of the O*Net Online and BLS descriptors are provided in Chapter IV (Tables 4.4 through 4.11). The restatement of the research questions are provided for review with the O*NET Online and BLS profile:

- What are the responsibilities of the Chief Information Officer?
- What are the core competencies of the Chief Information Officer?
- What are the skills needed to be a Chief Information Officer?

O*Net Online and U.S. Department of Labor: Bureau of Labor Statistics (BLS) Occupational Outlook Handbook	
Instructional Programs	***Abilities***
MANAGEMENT INFORMATION SYSTEMS AND BUSINESS DATA PROCESSING	Oral Comprehension
Work Values	Oral Expression
Independence	Written Comprehension
Achievement	Written Expression
Working Conditions	Number Facility
Recognition	Mathematical Reasoning
Relationships	Speech Clarity
Support	Deductive Reasoning
Generalized Work Activities	Near Vision
Getting Information Needed to Do the Job	Inductive Reasoning
Updating & Using Job-Relevant Knowledge	***Knowledge***
Guiding, Directing & Motivating Subordinates.	Administration and Management
Making Decisions and Solving Problems	Computers and Electronics
Coordinating Work & Activities of Others	Mathematics
Establishing & Maintaining Relationships	English Language
Developing and Building Teams	Economics and Accounting
Communicating With Other Workers	Education and Training
Implementing Ideas, Programs, etc.	Personnel and Human Resources
Scheduling Work and Activities	Customer and Personal Service
Skills	Clerical
Problem Identification	Psychology
Coordination	***Interests***
Judgment and Decision Making	Enterprising
Implementation Planning	Conventional
Writing	Investigative
Active Learning	***Job Zone Component***
Speaking	Overall Experience
Reading Comprehension	Job Training
Management of Personnel Resources	Education, Master's (Predominant)
Information Gathering	Education and Experience Factor (4-10 yrs)
	Job Zone Examples

Table 5.7 O*Net Online and BLS Occupational Handbook CI^2O Job Descriptions

The finding of the O*Net Online and the BLS as the profile for the CI^2O is important to defining what it is that organizations are looking for in the position. This comprehensive description of the seven areas discussed in the O*Net Online and BLS prepare the person looking to become the CI^20, the person looking to improve or evaluate their area(s) of weakness, and the organization that is looking for a specific type of person to fill a position or need. This is not the only answer to the questions presented the remainder is in the ability of the CI^2O to function in the environment of their job. The identification of the tools needed is provided in O*Net Online and the BLS. In addition, two tools for evaluating the environment an organization in which the CI2O was identified in the research studies presented. One tool is the model presented by the GAO study Figure 4.2 in Chapter IV. The GAO study presented the model of critical success factors which broke down further into the principles and finally into the detailed key characteristics. This model is important for the CI^2O to evaluate the organization's governance and its ability to implement and progress in the journey to the mature learning organization. The Second tool is the model discussed in the GartnerGroup study in Chapter IV, Table 4.3, the "Mutating CIO Species" model initially introduced by Ross & Feeny, Sloan School of Management. This model presents a mechanism to evaluate the organization and CI^2O's profiles and identify the gaps that exist in their views of information management and technology. The identification of the gaps between the two

entities will assist in determining the focus that the CI^2O will take to accomplish the mission of the organization.

B. SUMMARY

This chapter presented the compilation of the various areas that make up the CI^2O. A table of results on each of the areas that make up the environment and the CI^2O profile were presented to answer the research questions presented in chapter II. O*Net Online and the Bureau of Labor Statistics (BLS) framework was used for comparison of the CI^2O profile based on the study results. The results provided the conclusion that O*Net Online and the BLS requirements afford a good profile of what a well-rounded CI^2O should know and look like. In addition, two assessment tools were identified as enablers for the CI^2O to be successful in aligning with the organization's goals.

VI. CONCLUSIONS AND RECOMMENDATIONS

Based upon the research studies compilation and O*Net Online and U.S. Department of Labor: Bureau of Labor Statistics Computer and Information Systems managers description presented in this thesis a requirements profile for an individual to lead an organization's journey to excellence in information technology management was identified. The new title of Chief information Integration officer (CI^2O) was presented as a concise description of the individual that can meet these needs for the Navy in its journey to excel in an environment of "information superiority" in a mature learning organization.

The research indicates that the CI^2O cannot accomplish the IM/IT task alone. The Navy and each command must first identify and put several "things" in place. The most important is the information management governance. The governance will create an environment in which all personnel in an organization and Navy will conduct themselves. Governance spells out who is responsible for what and when. Without governance policies in place it will be difficult for any individual to function without developing alternate communication and political alliances. Another area the Navy needs to develop is the CI^2O position with clearly defined responsibilities and alignment with the enterprise and command's information management governance. The position needs to meet the definition of the CI^2O presented in this thesis. The position needs to have objective measures of effectiveness and performance. In addition, the command needs to position the CI^2O for success at the appropriate reporting level. Senior

leadership must embrace information management in regards to its central role in propelling the Navy to the realization of information superiority, and what the CI^2O brings to the table when discussing the business strategies. To be effective the CI^2O must be at the same level as other executives at the strategy table. This is not to say they need to be the same rank or paygrade. As a matter of fact this is not an issue about rank but that of sharing of information and creating relationships. Once the command has developed the position and the above-mentioned policies the climate is set. A screening process to acquire the CI^2O needs to be developed. The screening process would use the criteria described in the profile presented in this thesis for selecting a CI^2O.

The CI^2O position is very complex; the requirements to be successful have been reviewed by several analysts. Though the studies analyzed in this thesis vary, they have common threads: a CIO needs to have a business focus, good personal skills along with a technology background.

The research provides vast amounts of erudition into the position of the CIO. The study's definitions and findings in this thesis provided many common elements or attributes for the CI^2O. These findings and the information from O*Net Online and the U.S. Department of Labor: Bureau of Labor Statistics provided the data for the analysis and comparison to answer the questions posed for this thesis:

1. What does the CI^2O need to know?
2. What are the skills for the CI^2O?

3. What are the traits, characteristics and responsibilities for the CI^2O

To answer these questions one does not need to look any further than to the description provided in O*Net Online and the BLS. The description for the CI^2O is embodied in this existing toolset provided by O*Net Online and the Bureau of Labor Statistic's (BLS) description of the Computer and Information Systems Managers.

> The computer and information systems manager's job includes planning, coordinating, and directing research, design, production and computer-related activities. They may supervise engineers scientists, technicians, computer specialists, and information technology workers, along with support personnel.
>
> These managers use advanced technical knowledge of computer and information systems to oversee a variety of activities. They determine scientific and technical goals within broad outlines provided by top management. These goals may include the redesigning of an aircraft, improvements in manufacturing processes, the development of large computer networks, or advances in scientific research. Managers make detailed plans for the accomplishment of these goals...for example working with their staff they may develop the overall concepts of a new product or identify technical problems standing in the way of project completion. Another role of computer and information systems managers is to direct the work of systems analysts, computer programmers, and other computer related workers. These managers plan and coordinate activities such as installation and upgrading of hardware and software; programming and systems design (BLS).

The only addition to this definition is the increased level of involvement within the strategic planning and enterprise architectural planning responsibilities. The use of O*Net Online and the BLS profile in the development of the CI^2O position provide a thorough description and definition for the CI^2O in the Navy

organization of today and into the mature learning organization depicted in this thesis.

The Navy would benefit by having a CI^2O at all commands. The need is not just in managing the computers and the network. The value is much greater in the development and understanding of information management and the use of technologies to increase the efficiency and effectiveness of the workers. The CI^2O would also help the workers evolve into the knowledge workers of the future through a dynamic development process. The profile mentioned above and described in Chapters IV and V will prepare the CI^2O to function in the Navy command environment. The following are some examples of what the CI^2O needs to know to be successful:

The CI^2O needs to know the culture in which he/she is practicing, what and where the barriers are, who the informal leaders are and their sphere of influence. The CI^2O must know what relationships need to be built to form alliances.

The CI^2O must understand the business or industry in which they operate. Defining the information requirements of an organization is difficult enough if you understand the "lingo" of the organization, but an outsider coming in must undergo the learning process of how entities and personnel interface to develop a complete information management approach.

The CI^2O needs to know that it is not his/her responsibility alone to develop the information management governance but that of the executive leadership, in which he/she should be included.

The command organization structures should be organized around the information not departmentalized by specialty. Forming around specialties creates barriers and politics by who owns the information. Organizing around the information provides an opportunity to share information more openly minimizing the politics that are traditionally associated with organized structures.

The CI^2O needs to know the legislation and guidance put forth and educate the commands on the importance, advantages and disadvantages, costs and other implications of their implementation.

A CI^2O also needs to know that the environment is very unstable. The need to be flexible is very important to his/her success.

A CI^2O needs to "walk the talk" of business and translate "techno-babble" into the language of his/her peers. This translation of technology levels the playing field and allows for open communication and understanding of information technology and management. The list is endless.

The research has provided a compilation of the information from the six studies and presented a possible fit for the profile required for the CI^2O in the Navy. The O*Net Online and BLS profile focuses on the key areas initially stated in the thesis questions of what knowledge, skills, traits and responsibilities

required for the CI^2O to transition the Navy of today into the mature learning organization of the future.

A. SUGGESTED FURTHER RESEARCH

These suggestions represent areas in which further work would benefit the Navy and the CI^2O in fulfilling the requirements of information technology and management in a mature learning organization.

- Research the available CIO programs and compare them to the Department of Labors BLS.
- What does an organizational structure in the Navy look like with a CI^2O?
- Is this a position in each command where a civilian would be a better fit?
- Should the Navy develop a career path for officers to be CI^2O?
- What would a CI^2O officer's career path look like?
- If an officer is the right fit, is there one specialty or many?
- What would the curriculum for the CI^2O look like?
- How long does it take to develop a person to fit this CI^2O model?
- How does the Navy retain these knowledgeable and marketable individuals?
- How does this individual maintain currency in regards to the ever-changing technological world?

- Solicit leadership on their level of understanding of the requirements for information management.
- Develop a template for evaluating the information management requirements in commands.

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LIST OF REFERENCES

30-Something, Center for Executive Education: 30-Something web site, *August 2000.* Available at URL http://www.cee.nps.navy.mil/prod03.htm

Alberts, D.S., Garstka, J.J., & Stein, F.P., *Network Centric Warfare: developing and leveraging information superiority, (2nd ed.),* CCRP Publication Series. 2000.

Appleby, C., "Organized Chaos", *Hospital and Health Networks, July 20, 1997.*

Applegate, L. & Elam, J. 1992. "New Information Systems Leaders: A Changing Role in a Changing World", *MIS Quarterly, December 1992.*

Baatz, E. B., "THE CIO ROLE", *CIO Magazine, November 1, 1996.*

Baldwin, G., "CIO Secrets to Calculating Return on Investment", *Health Data Management, July 2000.*

Becker, N. J., "Implementing Technology in Higher Education: The Leadership Role Perspectives of The Chief Information Officer", *Dissertation Abstracts, February 1999.*

Bennis, W., "The Leadership Crisis", *Executive Excellence, July 1996.*

Bergman, R., "Health Care In A World", *Hospitals and Health Networks, August 20 1994.*

BLS, U.S. Department of Labor: Bureau of Labor Statistics, *Occupational Outlook Handbook, 2000-01 Edition* web site, *May 2000.* Available at URL http://www.bls.gov/oco/ocos009.htm

Bowman, M., (personal communication, August 24, 2000).

Broadbent, M., "Gartner Identifies Shift in CIO", *Advance for Healthcare Executives, web site. August 2000.* Available at URL http://www.advanceforhie.com/previousdnw/hxdnwjul10.html

CHIME, College of Healthcare Information Management Executives web site, *May 2000.* Available at URL http://www.chime-net.org/low

Corbin, L., "Getting a Seat at the Table", *Government Executive, March 1997.*

Cross, M., "Executive Focus: The Reel Thing", Health Data Management", *Health Data Management, February 2000.*

Deluca, J. M. & Cagan, R. E., *The CEO's Guide to Health Care Information Systems,* AHA Center for Health Care Leadership, American Hospital Publishing, 1996.

DOE, U.S. Department of Energy web site, *May 2000.* Available at URL http://www.er.doe.gov/production/er-60/sipfinal.htm

Drucker, P. F., "Coming of the New Organization", *Harvard Business Review, January-February, 1988.*

Drucker, P. F., "The Age of Social Transformation", *The Atlantic Monthly, November 1994.*

Earl, M.J., "Are CIOs Obsolete?", *Harvard Business Review, March-April, 2000.*

Feeny, D. Edwards, B. & Simpson, K., "Understanding the CEO/CIO Relationship", *MIS Quarterly, December 1992.*

Ferris, N., "Fitting In", *GovExec.COM, October 1997.* Available at URL http://www.govexec.com/features/1097s3.htm

Field, T., "THE CIO ROLE-The Missing Piece", *CIO Magazine, April 1, 1997.*

Frank, D., "Building a Blueprint for Agency CIOs", *Federal Computer Week, April 3, 2000.*

Frenzel, C. W., *The Management of Information Technology,* Boyd and Fraser, 1992.

GartnerGroup Inc., "Shaping CIO Agendas in an 'E' World", *Findings, May 26, 2000.*

Gates, W. H., III, *Business at the Speed of Thought*, Audio abridgement, Time Warner, 1999.

Gillespie, G., "CIOs Learn New Skills: Physicians, the Internet and Outsourcing are Driving CIOs to Develop Different Talents", *Health Data Management, March 2000.*

Government Accounting Office, "Implementing an Effective CIO Organization", FedDocs (GAO/AIMD-00-128), Washington, DC: U.S. Government Printing Office, March 2000.

Government Accounting Office, "NASA CHIEF INFORMATION OFFICER: Opportunities to Strengthen Information Resources Management", FedDocs (GAO/AIMD-96-78), Washington, DC: U.S. Government Printing Office, August 1996.

Grover, V., Jeong, S. R., Kettinger, W. R., & Lee, C. C., "The Chief Information Officer: A study of Managerial Roles", *Journal of Management Information Systems, October 1993.*

Heller, M., "How Are You Improving IS-User Relations?", *CIO Magazine, June 15, 2000.*

Hoffman, G. M., *The Technology Payoff,* Irwin Professional Publishing, 1994.

Horton, F., Jr., "IRM, The Invisible Revolution", *Computer World,* 1982.

Hunt P. D. & Willhelm, S. T., "Developing a Core Competency Model for Information Systems Management Officers in the United States Army", *Thesis Abstracts, June 2000.*

Hurd, R.S. 2000. "Survey Says: CFOs Don't Quite Get IT", *TechWeb, July 5, 2000.* Available at URL http://www.techweb.com/wire/story/TWB20000705S0016

IEEE, STD 610.12 Interoperable definition, web site, *August 2000.* Available at URL http://standards.ieee.org/cgi-bin/status

IRMC, Information Resource Management College web site, *May 2000.* Available at URL http://www.ndu.edu.irmc

IT21, Information Technology for the 21st Century web site, *August 2000.* Available at URL http://www.hq.navy.mil/IT-21/about.html

ITAA, Information Technology Association of America, web site. *August 2000.* Available at URL http://www.itaa.org/es/pp/99cio.htm

ITMRA, Information Technology Reform Act of 1996, Annotated version, August 8, 1996. Available at URL http://www.dtic.mil/c31/cio/itmra.Annot.html

JP1-02, Information Superiority Definition, web site. *August 2000.* Available at URL http://www.dtic.mil/doctrine/jrm/encyi_1.pdf

JTA, DoD Joint Technical Architecture, web site, *August 2000.* Available at URL http://www_jta.itsi.disa.mil

King, N. & Anderson, N., *Innovation and Change in Organization,* Routledge, New York, 1995.

Klug,L., "Hatred: An Update (CIO-CEO Relationships)", *Forbes October 7, 1996.*

Koch, C., "Sitting In The Hot Seat", *CIO Magazine, February 15, 1996.*

Leishman, M., "Define central vs. distribute information processing", *August 2000.* Available at URL http://www.newman.wa.edu.au/technology/12infsys/html/3_12htm

Lepore, D., "Are CIOs Obsolete?", *Harvard Business Review, March-April, 2000.*

Lytle, R. H., "Information Resource Management: A Five-Year Perspective", *Information Management Review, March 1988.*

Marchand, D.A., "Information Management: Strategies and Tools in Transition", *Information Management Review, January 1985.*

McAteer, P. & Elton, J., "Are CIOs Obsolete?", *Harvard Business Review, March-April, 2000.*

Mcdougall, P., & Mcgee, M. K., "How to Survive as a CIO", *Information week, November 1, 1999.*

Messmer, E., "U.S. Security Agency decides to Outsource IT", *Federal Computer Week, June 6, 2000.*

Moszkowicz, T. E., "Developing Core Competencies and Measures of Effectiveness for a Navy Medical Chief Information Officer", *Thesis Abstracts, September 1997.*

Negroponte, N., *Being digital,* Alfred A. Knopf, New York, 1995.

Onet, O*NET OnLine!, Snapshot web site, May, 2000, Available at URL http://online.onetcenter.org

O'Riordan, P., "The CIO: MIS Makes Its Move into the Executive Suite", *Journal of Information Systems Management, Summer 1997.*

Parry, S. R., "The Quest for Competencies", *Training, July 1996.*

Polansky, M., "Human Capital", *CIO Magazine, June 15, 2000.*

Porter, M. E. & Millar, V. E., "How Information Gives You Competitive Advantage", *Harvard Business Review July-August, 1985.*

Ray, M., "Information Resources Management: Four Cornerstones for Implementing IRM", *Information Management Review, February 1986.*

Robinson, B., "THE CIO ROLE: Trouble at the Top", *CIO Magazine, August 15, 2000.*

Rockart, J. F., Earl, M. J., & Ross J. W., "Eight Imperatives for the New IT Organization", *Sloan Management Review, Fall 1996.*

Rockart, J., "Are CIOs Obsolete?", *Harvard Business Review, March-April, 2000.*

Row, H., "THE CIO ROLE-Taking Care of Business", *CIO Magazine, April 1, 1997.*

Senge, P. M., *The Fifth Discipline,* Doubleday/Currency, 1990.

SIM, Society for Information Management web site, August 2000. Available at URL http://www.simnet.org

Smaltz, D. H., "Antecedents of CIO Effectiveness: A Role-Based Perspective", *Dissertation Abstract, Summer 1999.*

Smith, W. G., "Data Resource Management, Data Analysis & Repositories", *August 2000.* Available at URL http://www.barrettdata.com/drm/drm.htm

Stephens, Ledbetter, Mitra & Ford, "Executive or Functional Manager? The Nature of the CIO's Job"' *MIS Quarterly, December 1992.*

Strassman, P. A., *The Politics of Information Management: Policy Guidelines*, The Information Economics Press, Connecticut, 1995.

Synott, W.R. & Gruber, W. H., *Information Resource Management: Opportunities and Strategies for the 1980s*, John Wiley & Sons, New York, 1981.

TechWeb, TechEncyclopedia website, *August 2000.* Available at URL http://www.techweb.com/encyclopedia/defineterm

Thomas, T., "Are CIOs Obsolete?", *Harvard Business Review, March-April, 2000.*

Webster's Unabridged Dictionary 1913, Online Dictionary, *August 2000.* Available at URL http://www.dict.org/bin/Dict

Woodsworth, A., *Patterns and Options for Managing Information Technology on Campus*, American Library Association, Chicago, 1991.

WordNet, Online Dictionary, *August 2000.* Available at URL http://www.dict.org/bin/Dict

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